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ANTHROPOMETRY AS AN AID TO MENTAL DIAGNOSIS

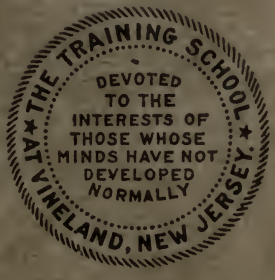
A SIMPLE METHOD FOR THE EXAMINATION OF SUB-NORMALS

BY

E. A. DOLL

ASSISTANT PSYCHOLOGIST, THE TRAINING SCHOOL AT VINELAND, N. J.

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF PEDAGOGY, NEW YORK UNIVERSITY



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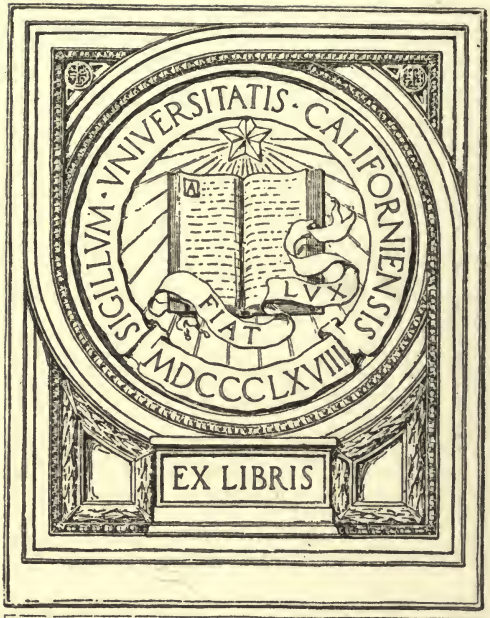
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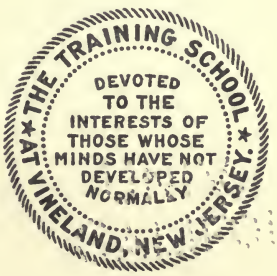

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FOREWORD

It is our hope that this report be considered in the nature of a preliminary study in the anthropometry of the feeble-minded. We have developed the treatment of the data from the point of view of mental tests, as an aid to diagnosis rather than as a contribution to anthropometry proper. Our primary aim is to establish a definite objective means of interpreting the measurements employed, measurements which are taken in nearly all laboratories and clinics but interpreted in few. We particularly urge that those who apply this method of interpretation consider the individual measurements not so much by themselves as in their relation to each other in the anthropometric curve, and that for individual cases due regard be paid to special conditions affecting each subject. These are, especially, physical deformities, pathological conditions, personal history (including nationality, parentage, previous health and nutrition, physiological status, physical and social environment, *et altera*), examinational conditions (such as time of day, season, weather), and other internal and external factors, like incentive, emulation, or their negatives. Data regarding these conditions and their effects could not be obtained in sufficient quantity or reliability to be of value in this study, but their importance should by no means be disregarded. The effect of these varying factors is illustrated in a research by E. L. Kuhnes (*Experimental Study of Dynamic Periodicity as Influenced by Diurnal, Weekly, Monthly, Seasonal and Yearly Efficiency*, Ped. Sem., Vol. XXII, No. 3, September 1915, pp. 326–346), from which it appears that motive, incentive, and such almost uncontrollable internal stimuli far outweigh all other factors. Only by controlled introspection, an impossibility with feeble-minded subjects or young children, can these effects be evaluated or allowed for.

Because our study is preliminary we have been constrained to avoid making definite conclusions, except so far as these are summary statements of results, and to refrain from any interpretation of the results. The author hopes to overcome this deficiency by a later investigation dealing with the body proportions of the feeble-minded in relation to age and mental ability. In view of the development of the theory that the feeble-minded tend toward a condition of organic and functional infantility, perhaps more general and complete than is ordinarily suspected, such a research seems

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unusually promising. It lies, however, beyond the limits of our present aims and means.

A preliminary report of this investigation was read at the 1914 meeting of the American Psychological Association under title of *The value of anthropometric measurements in the diagnosis of feeble-mindedness*, an abstract of the same appearing in the *Psychological Bulletin*, Vol. XII, No. 2, February 1915, p. 72, and also in the *Journal of Criminal Law and Criminology*, Vol. VI, No. 1, May 1915, p. 114. Since then the entire statistical material has been revised; new subjects have been added, mental ages have been accurately verified, subjects with such physical defects as would affect the measurements, and also subjects over 40 years of age have been excluded. The data have also been carefully surveyed for reliability of measures.

Credit is due Dr. H. H. Goddard for his original studies in this field, and for initiating the present study. Mr. S. C. Kohs first pointed out the significance of the "slope" of the anthropometric curve and the method of expressing this relationship. In particular I desire to express my personal thanks to Miss Louise Bishop and Miss Edith Taylor, formerly research students at the Vineland Laboratory, for their persevering assistance in tabulating the data and preparing the statistical tables. I am indebted also to Prof. G. M. Whipple for helpful corrections of manuscript.

ANTHROPOMETRY AS AN AID TO MENTAL DIAGNOSIS

Introduction

As early as 1892, Porter (17)[1] concluded from a study of 33,500 children that there is a physical basis of mental precocity, that dull children are lighter than the average child and precocious children heavier, that mediocrity of mind is correlated with mediocrity of physique. Christopher (6) later reinvestigated Porter's conclusion and confirmed it. Smedley (22), in 1899, further demonstrated that "the evolutionary ideal child stood somewhere above the average in each measurement," and that "the more advanced pupils stood higher in the physical measurements than the backward ones." In 1900, Smedley (21) confirmed his own results of the previous year and from data divested of the influence of age and sex showed the existence of a direct correlation between physical condition and mental capacity, concluding that children physically superior were superior in school efficiency, and that this held true for all of his measurements. Gratsianoff (13) and Sack (18), in Russia, and MacDonald (14), Beyer (4), and DeBusk (8), in America, also found successful children larger than unsuccessful. Galton (9), on the other hand, with adults, found no connection between success in literary examinations (at Cambridge) and stature, weight, strength, or breathing capacity. West (25), too, found an inverse relation between brightness and size, while Gilbert (10, 11) found no relationship.

Goddard (12), in 1912, presented the first conclusive study of physical measurements with the feeble-minded, although Tarbell (23), Shuttleworth (20), and Wylie (27, 28) had preceded him with studies based upon comparatively few cases. Tarbell, in 1881, from data on perhaps 130 children concluded that the feeble-minded were both shorter and lighter than the normal. Three years later Shuttleworth published a curve of growth for mental defectives, constructed from data on about 1200 cases from English institutions. These results agreed with those of Tarbell. In 1899, and again in 1903, Wylie reported in confirmation of these previous findings, adding that variability is much greater with defectives than with normals. Goddard, finally, collected data on approximately

[1] Numbers in parentheses refer to the list of appended references.

6000 feeble-minded males and 5000 feeble-minded females, ranging in age from birth to 60 years, gathered from 19 American institutions for the feeble-minded. His tables and curves unquestionably demonstrated that with but slight exceptions the feeble-minded of both sexes are below the normal averages, and that the degree of subnormality bears a direct relation to the degree of mental defect, with the highest grades, the morons, closely approximating the normal, this last in agreement with the conclusion of Miss Norsworthy (16), who had studied mental defectives at Waverly, Mass., in 1906. To these studies may be added the recent contribution by Mead (15). From data on 284 feeble-minded boys and 122 feeble-minded girls, compared with an approximately equal number of normal school children, he concluded that "not only is mental defect reflected on the average in the height and weight of children, but the more decided the defect the more checked the physical growth;" also that "this is more evident in height than weight;" that "feeble-minded girls more nearly approximate normal girls than do feeble-minded boys approximate normal boys;" and that defectives are more variable than normals in height and, after the thirteenth year, also in weight. Thus all Mead's conclusions confirmed previous results. This general relation of mental capacity to physical growth is again found to hold among normal children in the quite recent study by Baldwin (1), who affirms ". . . . it may be seen that the majority of children above median height are in or above normal grade and above the average in marks. Of those below median height the majority of children are below or in normal grade and below average mark."[2]

The investigations thus far referred to have dealt chiefly with measurements of height and weight. In the field of measurements of normal subjects a few of the studies of physical measurements, notably that of Smedley (22), included strength of grip and vital capacity. A few studies have been made upon normal subjects with special reference to vital capacity or strength of grip, but with the exception of Wallin's (24) study of manuometry with epileptics and feeble-minded we are not aware of any study of these measurements with mental defectives. From these investigations we may note briefly a few conclusions which are related to those emanating from the present study. All investigators agree that in vital

[2] This historical review is purposely curtailed and sketchy. More complete and extended summaries may be found in Whipple (26, Tests 1, 2, 5, and 6) and in Baldwin (2). The latter contains an exhaustive annotated bibliography, including several historical summaries. Goddard (12) gives an historical review with special reference to the feeble-minded.

capacity boys are superior to girls, and men to women; that the norm is conditioned by weight; that there is a general increase with age, and a dependence upon mode of life. Gilbert (10, 11) found an indifferent relation between performance of bright and of dull children, but Smedley (21, 22) found a positive correlation between school standing and vital capacity, and DeBusk (8) also found bright children superior to dull. In strength of grip males are superior to females; there is a dependence upon the seasons, incentives, and social status. Smedley (21, 22), Schuyten (19), and Miss Carman (5) found positive correlations between strength of grip and intelligence, although MacDonald (14) came to a contrary conclusion. Barr (3) has stated from observation that mental grasp and hand grasp go hand in hand. Wallin (24) clearly showed high grade epileptics superior in grip to low grade, and Dawson (7) found delinquent children below normal children. All studies of dextrality in mental defectives tend to the conclusion that mental defectives are predominantly left-handed or ambidextrous. Goddard has for some years held that the feeble-minded are markedly below normal in strength of grip, with left superior to right, and that they are even more subnormal in vital capacity, with only an occasional defective approximating the normal. There still hangs in the Vineland Laboratory a time-worn chart of the relationship of physical and psycho-physical measurements to grade of defect, in which both sets of measurements are below normal, with the psycho-physical much below the physical, the curves becoming increasingly subnormal with the lower grades of feeble-mindedness.

With such concurrence of opinion it may seem unnecessary to offer further evidence. But as yet there has been no single study of the feeble-minded showing the specific relations of these several physical and psycho-physical measurements to each other, or to mental defect accurately rated in terms of intellectual levels. Moreover, preceding researches have dealt always with absolute measurements. This report is unique in that it deals with percentile comparisons of defectives with normals and treats all measurements in their specific relationships and in relation to exact mental levels.

Material

The data of this study have been obtained from the file of anthropometric data assembled since the establishment of the Research Laboratory at The Training School. The earliest investigations of this Laboratory included measurements of standing height, sitting height, and weight, herein specifically referred to as physical measurements, and tests of right

grip, left grip, and vital capacity, herein specifically referred to as psychophysical measurements. These measurements were made on most of the "children" then at The Training School, and since then have been repeated annually with many of them. The first examinations of entrants since that time have also included these measurements, with later repetitions on most cases. In 1912, Mr. S. C. Kohs made these measurements upon all children in the School that year, and since then several research students, carefully instructed in the methods of examination, have, with the writer continued the measurements.

From this working file of data a single set of measurements for each child, usually the most recent one, has been selected for the purposes of this study. "Children" over 40 years of age as well as those having such physical defects as would affect the measurements (lameness, broken limbs, malformations, ataxia, paralysis, etc.) were excluded. These selected measurements include all other children of the School of whatever mental age or type and were taken, in practically all instances, in 1912, 1913, and 1914. Of the 477 sets of measurements which comprise the data, the author personally obtained one-third, Miss Norma Cutts one-fifth, and Mr. S. C. Kohs one-seventh. The remaining third were made by a number of different examiners under close supervision. The treatment of the data has been limited to conditions of mental age, chronological age, and sex; information regarding race, nationality, heredity, pathological type, and special personal history has been available in some cases, but not in sufficient quantity or reliability to warrant a study of the effect of these conditions except for individual cases. The repeated measurements were not available in sufficient number or reliability to be valuable for a study of growth increments or coefficients of reliability.

Method

The measurements have been made on the subjects in shoes and ordinary clothing. The resulting error with respect to height is not considerable, since the shoes worn by these subjects are practically heelless; there is probably a constant plus error in standing height amounting to not more than 1 cm. Typical clothing also is not so heavy as among normals, giving a probable plus error of not more than 2.5 kg. Both these errors result in an error of comparison in favor of the defective subjects. Were they absent the conclusions would be even more positive.

Height was measured with a stadiometer graduated to mm., with adjustable cross-arm. The subject stood erect, heel to heel against the upright

rod; head level.[3] (A decided qualitative symptom is often found in the manner in which the feeble-minded subject stands up to the stadiometer. It is expressed by the stoop in the knees, the flat feet, the poor physical tone, the round shoulders, and the sharp inclination of the chin in holding up the head. Many face the measuring rod or place their feet astride the base-board. The normal, intelligent child, on the contrary, seems at once to know what is wanted and backs himself against the measuring rod with military erectness. It is not always possible to overcome the poor physical tone of defectives, and there results a small minus error which offsets to some degree the plus error of shoes.)

For sitting height the stadiometer was placed upon a chair of suitable height and the subject seated on the base-board. (It is curious to note how many defectives attempt to step up on the stadiometer in this position instead of accepting, as does the normal child, the implication to sit.)

Weight was measured with a Fairbanks scale graduated to hectograms. No difficulty is experienced in taking this measurement, except that it is difficult to induce low-grade children to step upon the platform, and once there, to keep them from holding themselves against the parts of the scale; their sense of equilibrium seems so easily disturbed (witness also ataxiagraphic experiments) that it is with difficulty that they hold their position upon the slightly-swaying platform.

Right and left grip were taken with a Smedley improved dynamometer, the subject standing. To suit the instrument to each subject's hand the examiner adjusted the movable stirrup by trial and error so that when the hand was loosely flexed and ready for the pull the instrument lay squarely in the palm, facing upward, with the outer frame set firmly against the fleshy base of the thumb and the inner edge of the stirrup touching the second phalanges of the fingers. In most cases the experimenter also lightly held the tip of the instrument to assist in proper procedure. This is of some assistance to the subject in controlling the position of the instrument and in keeping the dial in view, and is more necessary with low-grade children than with the higher grades. Three trials were taken with each hand alternately and the highest pull for each hand was recorded. (Qualitatively there is again considerable value in observing the reaction of the subject to the test, the awkwardness of the hands, the enormous effort without appreciable result, the facial distortion and spasmodic body movements. The lower-grade cases, although unable in this test to grip 10

[3] For defectives it is advisable that the base-board should be not more than an inch from the floor; the stadiometer may then be placed on a chair of suitable height when measuring sitting height.

kilograms, easily manage heavily-loaded wheel-barrows or lift exceptionally heavy weights.)

Vital capacity was measured with a small-bore wet spirometer of special type recording by single cubic centimeters. Expiration was made through a connecting hose-tube fitted with ordinary sanitary wooden mouth-pieces. (This test offers much greater difficulty than the others with defectives. The typical low-grade subjects are unaccountably timid in the experiment and often refuse to approach the instrument. They ordinarily yield to coaxing or cajolery, but may become excited at any insistence.) It was necessary to give careful instruction, supplemented by personal demonstration, as to the manner of performing the experiment. Preliminary inspiration and expiration without the tube was advisable before taking a record. Again the best of three trials was recorded. (Observations of some value can be made, such as blowing around instead of through the mouth-piece, holding the mouth-piece in helpless or stupid fashion, blowing through the nose, stopping the mouth-piece with the tongue, blowing oftener than once, re-inspiring from the instrument.) It is remarkable how almost unfailingly the record was below normal and in most cases far below. Less than 8 per cent of the cases here reported reached the normal average.

Treatment of Data

In seeking a means of accurately determining the amounts and kinds of differences between normal and feeble-minded children in these measurements the Smedley percentile tables were selected as the best suited to the purpose. In Child-Study Report No. 3 (21), issued by the Department of Child-Study and Pedagogic Investigation of the Chicago Public Schools, Fred Warren Smedley has classified into percentile tables the measurements of several thousand school children with respect to standing height, sitting height, weight, right grip, left grip, and vital capacity. This report is now out of print; we therefore quote these tables in full in the appendix. In the words of the report (21, p. 13):

"Tables have thus been produced which will be of especial service in the Child-Study Laboratory and of value to all who make a study of individual children. By means of these tables one can determine closely how a given child compares with others of his age. These percentiles have been obtained in the following manner: The individual cards on which the measurements were recorded when the child was tested were arranged according to the size of the pupils in each measurement, grouped separately for each age in years. The minimum measurement in each such group gave the zero percentile for that group. To determine the ten percentile for that group, ten per cent of the number of cards was removed, beginning at the minimal end, and the highest measurement on the cards so removed was recorded as the desired ten percentile. Similarly the other per-

centiles were determined, the maximum measurement being recorded as the one hundred percentile."

These tables make it possible to compare the measurements of an individual child with the normal averages for its age and sex. The tables are also of value in showing the balance of growth and development, as shown by direct comparison of the several derived percentiles with each other.

To derive a comparison percentile from the numerical tables one refers to the proper table for age and sex, and there, by inspection and a simple method of interpolation, finds the exact position of the individual in each measurement on the scale of 100. Specifically, to find the exact interpolated percentile of any measurement; first, find the table corresponding to the subject's sex, and to his age at the last birthday; second, for each measurement find the two percentiles of the table between which the given measurement lies; third, subtract the value of the lower limiting percentile from the given measurement; fourth, divide this difference by the difference between the values of both limiting percentiles; fifth, multiply this decimal by 10 (the difference between the two percentiles) and add to the lower limiting percentile.

For the treatment of values above the 100-percentile we have assumed the difference between the 90-percentile value and the 100-percentile value (for each table and measurement) to be a constant, applying equally to hypothetical percentile groups beyond the 100-percentile; similarly for values falling below the 0-percentile value we have assumed the difference between the 10-percentile value and the 0-percentile value to be a constant, operating equally to successive hypothetical percentile groups below 0. Thus, to determine the percentile for a value which lies beyond the highest limit of a table, subtract the 100-percentile value from the given value, divide this difference by the difference between the 90-percentile value and the 100-percentile value, multiply this quotient by 10 and add the result to 100. Similarly, for a value which lies below the lowest limit of a table, subtract the 0-percentile value algebraically from the given value, divide this difference by the difference between the 0-value and the 10-value, multiply by 10 and add to 0, retaining algebraic sign. This method is obviously open to error, but seems superior to other methods which have suggested themselves. The error is probably not great, and such as it is operates in favor of the compared value, since the difference between values for the successive percentiles increases geometrically rather than arithmetically as the percentile lies farther above or below 50, the median.

To relate these derived percentiles to each other graphically they may be plotted on graph sheets in which the separate measurements are represented along the abscissae and the percentiles along the ordinates of artificially constructed coördinate points (see pages 73 and 74).[4] To illustrate the specific computation and graphing, consider Plate II, page 73, Ben ——, C ——. Here is a boy, aged 13.8, who measures 1518 mm. in standing height, 732 mm. in sitting height, 32.6 kg. in weight, 19.5 kg. in right grip, 20.0 kg. in left grip, and 820 cc. in vital capacity. To compare this individual with the norms for his age and sex we refer to the table of percentiles for 13-year boys (age always taken to last birthday). Here we find that the given measurement for standing height, 1518,

[4] Record and graph sheets similar to those used in the cuts may be obtained at cost from the Research Department, The Training School, Vineland, N. J. We are not aware of their being published elsewhere.

lies between the values for the 60 and 70-percentiles in the table. By dividing the excess of 1518, the given value, over 1505, the value of the lower limiting percentile, by 23, the difference between the two percentile values, we obtain the quotient 0.6, which multiplied by 10, the difference between the two percentiles, and added to 60, the lower limiting percentile, gives the desired interpolated value, 66. By inspection, the given measurement in sitting height, 732, is found to correspond exactly with the 10-percentile in the table and interpolation is unnecessary. And so on for the other values. The value for vital capacity, however, 820, falls outside the lowest limit of the table; we therefore subtract the 0-percentile value, 1500, from it, divide this difference by the difference between the 0 and 10-percentile values, 300, multiply the result by 10 and add the result, −23, to 0.

To graph the percentiles of the measurements, place a point on the graph sheet midway in the space for each measurement at a height corresponding to the computed percentile for that measurement. To draw the "curve" connect successive points by straight lines from left to right. To draw the "slope" for the curve, average the first three percentiles (physical), and the second three (psycho-physical); locate the physical average as an ordinate in the space for sitting height, and the psycho-physical average as an ordinate in the space for left grip. Connect these two points by a straight line. The significance of this slope is discussed later.

The age for which each measurement is most nearly average may be found by seeking the age-tables (for that sex) in which the measurements most closely approximate the 50-percentile, which may be considered the average (more exactly, the median) for each age. Thus, in the case cited, the boy aged 13 is "at age" in standing height, is average for 11 years in sitting height and in weight, for 12 years in grips, and for 5 years in vital capacity. He is therefore average for 12-year-old boys physically, and may be said to be one year retarded in physical development. The curve drawn for the age at which his physical measurements are most nearly average has in this case the same character as the first curve drawn at age. This second curve sometimes reveals shifts in the character of the curve. It gives the child the allowance for the physical subnormality.

Smedley's tables for "twenty-one years and over" seem not so reliable as those for the lower ages. For this reason we have compared the measurements of our subjects who were over twenty years of age with the tables for age twenty.

Perhaps some of those who wish to apply our method and results may have need of transferring their measurements from the English to the metric system of units. For their convenience we cite these conversion values: To convert inches to mm. multiply by 25.4 or divide by .0394; to convert pounds to kg. multiply by .0453 or divide by 2.206; to convert cubic inches to cc. multiply by 16.4 or divide by .061. To convert from metric to English units apply these constants in reverse order.

From the very first it was patent that such comparative measurements were of distinct clinical value in the diagnosis of mental defect. Compared with the Smedley percentile tables the feeble-minded of all ages and grades were clearly sub-normal in physical measurements, and even more sub-normal in psycho-physical measurements; the amount of sub-normality increased with the degree of defect. The specific character of the Smedley anthropometric curve was also considered valuable, especially in regard to its typical downward slope. In 1912, Mr. S. C. Kohs, then a research student at the Laboratory, attempted to express the curve mathematically.

He reasoned that by constructing a connecting line between the percentiles of standing height and weight, and another between those of right grip and vital capacity, the resulting triangles might be considered as geometrical expressions of physical and psycho-physical capacity, and that their relation to each other might be expressed in a straight line connecting the geometrical centers of these triangles. But the curve does not permit of geometrical or mathematical interpretation, for the abscissae distances are not functions of the ordinates but are artificially chosen; the relative succession of the measurements is also artificial. We now consider that the best expression for the slope is, as Dr. H. H. Goddard later pointed out, the simple absolute ratio of the average of the three physical percentiles to the average of the three psycho-physical percentiles; this ratio should not be reduced to the decimal, since this does not show the position of the slope, although it gives its angle. Later results show that this position of the curve high or low on the graph is a better expression of the degree of mental defect than is the angle of the curve as was at first expected.

The selected sets of individual measurements described above were transferred to cards. The percentile for each measurement was then found by comparison with the Smedley tables as described. The first three percentiles were averaged and termed the physical average, the last three percentiles also were averaged and termed the psycho-physical average. The average of all the percentiles was computed and termed the total average. The psycho-physical average was then algebraically subtracted from the physical average and the result termed the physical excess, that is, the superiority of the physical over the psycho-physical average with the latter reduced to zero. The cards bearing these data were then classified by sex and by mental age, and by chronological age within mental age. The data so classified were then treated statistically for means, variability, sex differences, and correlations. Percentiles were used throughout the computations rather than the original measurements, because therein lies the chief diagnostic value of the measurements. So far as the data are of value for comparative anthropometry instead of for diagnosis, it might have been better to have based the computations on the absolute measurements. The percentiles, however, have the additional advantage of being directly comparable with each other and with the normal average, and were expected to be divested of influence of age and sex. This latter expectation was disappointed, since the theoretical elimination of the influence of age and sex did not eliminate these conditions in relation to normals. This proved to be an important addition to the other results.

Chronological age for each child was computed from the birthday preceding the date of measurements. Median ages, therefore, as in the

Smedley tables, are in half years; age 8, for instance, means 8–9, median 8.5. Similarly, mental age for each child was that which obtained at the date of the measurements and has been taken to the lower full year of mental age as obtained from Binet tests; thus mental age 6 means 6–7, median 6.5.

Data

Table 1 shows the original measurements for individual girls classified by mental ages and arranged in order of chronological age. Table 2 shows the same for boys. Reading from left to right the columns show years of age to last birthday, mm. of standing height, mm. of sitting height, kg. of weight, kg. of right grip, kg. of left grip, and cc. of vital capacity. For example, the first subject in Table 1 is a girl of mental age 1, whose chronological age is 8, and who measures 1114 mm. in standing height, 595 mm. in sitting height, and 17.5 kg. in weight; she fails entirely in the tests of grip and vital capacity, with a consequent measurement of 0 for each. The tables are not averaged, since the measurements are not directly comparable unless divested of influence of chronological age. They are presented for reference and for verification of the derived data.

Tables 3 and 4 show the percentiles derived from Tables 1 and 2, respectively, according to the method described above. By columns, from left to right, they show years of chronological age, percentiles of standing height percentiles of sitting height, percentiles of weight, percentiles of right grip, percentiles of left grip, percentiles of vital capacity, average of the physical percentiles (heights and weight), average of the psycho-physical percentiles (grips and vital capacity), average of the original six percentiles, and excess of physical average percentiles over psycho-physical average percentiles. For example, the first line of Table 3 represents the comparison percentiles of the original measurements for the first line of Table 1, and shows a girl of mental age 1, whose chronological age is 8, whose height corresponds to the 8-percentile for normal girls of her chronological age (that is, would rank 8 on the scale of 100), whose sitting height is 2 ranks below the lowest normal ranking for the same age and sex, and whose weight is equal to the lowest normal of her age. In strength of right and of left grip and in vital capacity she ranks, respectively, –20, –16, and –11, on the scale of 100. In the average of the three physical measurements (standing height, sitting height, and weight) she ranks 2 on the scale of 100, and in the average of the three psycho-physical measurements (right grip, left grip, and vital capacity) she ranks –16 on the scale of 100. In all six measurements taken together she ranks –7, and the physical average

rank is 18 ranks above the psycho-physical average rank. Four summations of these percentiles are given in successive horizontal columns at the base of each table; the mean average for each column, the mean variation for each column in relation to that average, the coefficient of variability, and the number of cases approximating the normal median average, the 50-percentile.

The averages for the columns of Tables 3 and 4 are collected into Tables 5 and 6, with the coefficients of variability in Tables 7 and 8. To permit of comparing averages by types of feeble-mindedness instead of by exact mental levels, Tables 9 and 10 have been prepared to show the percentile averages for idiots (mental ages 1–2), imbeciles (mental ages 3–7), and morons (mental ages 8–11). Tables 11 and 12 are summation tables of the number reaching the normal average (the 50-percentile) at each mental age, with the percentage of all for each sex.

Table 13 gives the Pearson coefficients of correlation between the percentiles and the mental ages, corrected for constriction of chronological age, while Table 14 gives similar coefficients between percentiles and chronological age, corrected for constriction of mental age.

Table 15 presents the raw Pearson coefficients of correlation between the percentiles, and Table 16 gives these same correlations corrected for dual constriction of age and mental age. Table 17 is of some interest as indicating the rank order of these corrected coefficients and showing the relative ranking for the sexes.

The coefficients of correlation have been derived through the formula $r = \frac{\Sigma xy}{n \sigma_1 \sigma_2}$, where r is the desired coefficient of correlation; x represents the deviations from the average of the first term; y those from the second term; n the number of cases; σ_1 the standard deviation of the first term; and σ_2 that of the second term. Correction of r for constriction due to one irrelevant factor affecting both of the original terms has been obtained through the formula $AB \cdot C = \frac{AB - (AC \times BC)}{\sqrt{(1 - \overline{AC}^2)\ (1 - \overline{BC}^2)}}$, where A and B are the original terms; C is the irrelevant factor affecting both terms; AB the original r between A and B; AC the correlation between A and C; BC the correlation between B and C; and $AB \cdot C$ the correlation between A and B corrected for the influence of C. Correction of r for two irrelevant factors affecting both of the original terms has been obtained through the formula $AB \cdot CD = \frac{AB \cdot C - (AD \cdot C \times BD \cdot C)}{\sqrt{(1 - \overline{AD \cdot C}^2)\ (1 - \overline{BD \cdot C}^2)}}$, in which

A and B are the original terms; C and D the two irrelevant factors; $AB \cdot CD$ the correlation between A and B corrected for both C and D; $AB \cdot C$ the correlation between A and B corrected for C; $AD \cdot C$ the correlation between A and D corrected for C; and $BD \cdot C$ the correlation between B and D corrected for C. These correction formulae are taken, with change of notation, from Yule's *An Introduction to the Theory of Statistics*, page 234, formula 12. The correlations are so obviously high in relation to the number of cases that probable errors were not tabulated. They may be derived through the formula $P.\ E._{r} = .6745\frac{1-r^2}{\sqrt{n}}$, and will be found to range from .03 to .05 for girls and from .01 to .03 for boys.

Figures 1 to 12 graphically represent the numerical percentile averages in Tables 5 and 6. The accompanying text is self-explanatory.

The curves and certain of the summation tables do not include the averages for mental age 11. There are so few cases at this age that it hardly seems fair to include them in the total results. Moreover, there is doubt in some quarters regarding the reliability of mental age 11 as derived from Binet-Simon tests, so that it might seem objectionable to include that age.

TABLE 1

Original Measurements—9 Girls. Mental Age 1

AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP
	mm.	*mm.*	*kg.*	*kg.*	*kg.*	*cc.*
8	1114	595	17.5	0.0	0.0	0
11	1434	775	55.6	0.5	1.0	0
11	1240	650	24.3	0.0	0.0	0
12	1389	701	33.1	1.5	2.0	0
15	1503	792	44.2	0.0	1.5	0
16	1515	770	44.0	0.0	0.0	0
18	1450	700	30.1	0.0	0.0	0
19	1400	745	33.9	4.0	2.0	0
25	1350	750	46.0	0.0	0.0	0
	Original Measurements—29 Girls. Mental Age 2					
5	1175	655	23.6	5.0	6.0	0
6	1143	643	22.0	0.0	0.0	0
6	1145	610	22.0	0.0	0.0	0
7	1039	582	18.8	0.0	0.0	0
7	1188	650	22.6	3.0	3.0	0
8	1050	500	17.0	0.0	0.0	0
9	1039	629	23.8	4.0	8.5	450
10	1300	680	25.8	3.0	3.0	0
10	1239	651	23.6	6.0	7.0	590
12	1475	795	39.4	0.0	0.0	0
12	1292	684	24.8	2.5	3.5	0
13	1405	755	31.6	5.0	5.5	400
13	1132	648	20.2	0.0	0.0	0
13	1410	769	46.2	17.5	15.0	430
14	1477	758	41.1	7.0	9.5	300
15	1585	820	46.1	0.0	0.0	0
16	1530	790	51.9	11.0	15.0	320
17	1481	788	43.7	0.0	0.0	0
17	1500	820	38.8	0.0	0.0	0
18	1593	820	53.4	12.0	10.0	0
19	1420	820	43.6	16.5	22.0	950
21	1578	820	55.0	0.0	1.0	500
24	1571	850	58.5	9.0	20.0	900
24	1497	825	46.9	0.0	0.0	0
25	1492	785	42.8	0.0	0.0	0
29	1500	754	54.6	0.0	0.0	0
30	1438	767	45.0	8.0	1.5	0
32	1578	832	62.2	5.0	12.0	300
37	1520	808	57.5	0.0	0.0	0

TABLE 1—Continued

Original Measurements—15 Girls. Mental Age 3

AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.
	mm.	*mm.*	*kg.*	*kg.*	*kg.*	*cc.*
7	1100	632	20.5	5.0	9.0	0
8	963	536	15.0	5.0	5.5	380
10	1203	637	24.0	5.0	4.0	350
10	1423	741	34.8	6.0	8.5	260
10	1260	685	25.5	7.0	7.0	500
11	1320	692	26.1	11.5	15.5	450
12	1552	818	49.9	19.0	21.5	300
14	1381	758	37.1	9.0	7.5	760
15	1429	758	41.3	15.0	14.0	500
16	1597	850	48.6	15.0	20.0	150
16	1605	860	46.4	20.0	16.5	500
17	1621	822	64.0	15.0	22.5	740
22	1668	867	51.4	15.5	12.0	650
27	1489	784	37.3	2.5	3.5	320
29	1417	819	41.5	10.0	6.1	900

Original Measurements—10 Girls. Mental Age 4

9	1073	558	19.5	3.0	2.0	150
11	1379	730	35.4	16.0	17.0	1020
11	1230	610	22.0	9.0	9.0	500
11	1254	648	24.6	8.0	6.0	450
14	1533	825	48.2	8.0	6.5	120
16	1541	813	53.8	22.0	18.5	1300
16	1349	759	36.4	16.0	14.0	700
16	1459	780	38.8	10.5	12.5	840
18	1470	818	46.6	21.5	18.0	785
23	1430	830	60.7	25.5	18.5	900

Original Measurements—15 Girls. Mental Age 5

8	1157	620	20.4	9.0	8.0	650
8	1200	675	23.2	14.0	11.0	850
9	1333	712	32.3	12.0	15.0	695
10	1210	678	21.4	9.5	11.0	800
13	1472	773	36.0	10.0	15.5	520
13	1545	800	50.2	7.5	10.0	780
14	1500	780	38.4	17.0	15.0	800
14	1460	793	44.7	11.0	18.5	1200
15	1465	800	52.2	18.0	21.1	1000
20	1545	809	73.0	11.5	17.5	790

TABLE 1—Continued

Original Measurements—15 Girls. Mental Age 5—Continued

AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.
	mm.	*mm.*	*kg.*	*kg.*	*kg.*	*cc.*
21	1575	810	54.0	31.0	28.0	1430
22	1510	820	56.0	23.0	19.0	1350
25	1517	715	42.6	20.0	24.0	1050
28	1522	833	50.6	21.5	23.0	1900
30	1630	830	54.4	29.0	28.0	1100

Original Measurements—13 Girls. Mental Age 6

9	1464	764	34.0	21.0	21.0	1070
9	1337	713	28.3	11.5	13.5	1063
12	1500	799	44.6	18.0	16.5	1720
14	1480	770	41.0	9.0	8.0	520
14	1521	803	43.8	22.0	25.5	1010
15	1559	837	51.8	27.0	17.0	1810
18	1630	862	54.2	29.5	24.0	1230
20	1440	782	42.4	12.5	12.5	300
21	1612	833	57.4	29.0	27.5	1900
27	1527	850	56.1	27.5	23.5	2090
30	1538	782	46.2	5.0	13.0	1120
31	1495	854	88.8	21.5	16.0	1000
38	1611	854	54.6	18.5	20.0	1500

Original Measurements—23 Girls. Mental Age 7

9	1202	662	22.6	14.5	12.0	650
9	1302	689	28.2	17.5	12.5	1250
9	1348	696	27.4	18.0	19.5	1340
10	1310	720	28.4	16.0	15.0	900
11	1425	785	38.4	21.0	20.0	1750
12	1380	750	30.5	16.0	15.5	1560
12	1560	794	40.4	24.0	22.0	1640
13	1533	820	54.6	15.5	15.0	1250
14	1711	875	58.0	25.0	26.0	3270
14	1548	829	42.2	22.5	29.0	2530
18	1560	840	49.0	15.0	12.5	250
18	1533	822	51.4	21.0	22.5	1320
19	1580	810	58.0	20.0	15.0	440
24	1460	815	36.6	13.0	11.0	1255
24	1554	840	82.2	28.5	32.0	1610
26	1539	825	43.6	26.0	24.5	1830

TABLE 1—Continued

Original Measurements—23 Girls. Mental Age 7—Continued

AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.
	mm.	*mm.*	*kg.*	*kg.*	*kg.*	*cc.*
27	1641	855	59.0	27.0	26.0	2400
28	1610	855	48.6	24.0	22.0	1000
28	1625	856	49.8	27.0	24.0	970
28	1540	770	40.4	21.0	24.5	1640
30	1648	915	59.1	21.5	29.0	2840
36	1635	821	52.7	31.0	35.5	1535
38	1600	825	85.0	27.5	33.5	1900
	Original Measurements—9 Girls. Mental Age 8					
13	1530	785	39.8	14.5	7.0	1330
13	1570	801	45.4	20.0	19.0	1470
13	1507	795	46.4	15.5	11.5	1350
17	1715	895	61.0	30.0	31.0	1300
21	1554	819	55.2	27.0	23.0	1710
24	1510	861	59.0	21.5	18.0	2030
25	1528	808	49.5	25.5	22.0	1080
32	1503	832	47.6	26.0	28.0	1225
37	1479	792	68.2	22.5	27.2	845
	Original Measurements—12 Girls. Mental Age 9					
12	1522	765	40.2	25.0	26.0	2160
18	1588	848	50.1	24.0	24.0	2130
19	1688	879	56.2	34.0	29.0	2350
19	1703	892	75.7	25.5	29.5	2750
19	1594	863	61.6	40.5	33.0	2450
22	1565	848	50.3	30.0	32.0	2260
23	1613	854	47.4	27.0	25.0	2260
25	1570	838	52.1	35.0	30.0	2050
30	1585	865	45.2	21.0	15.0	1040
31	1500	810	51.4	24.9	26.0	2160
31	1562	805	40.0	22.0	23.0	2350
36	1518	830	62.8	25.0	20.0	1730
	Original Measurements—5 Girls. Mental Age 10					
24	1630	858	56.8	24.5	26.5	1775
24	1628	855	64.3	32.0	24.0	2810
27	1559	839	57.8	21.5	28.5	1470
31	1502	868	57.6	33.5	37.5	1600
34	1586	874	56.0	33.4	30.3	1700
	Original Measurements—1 Girl. Mental Age 11					
17	1628	865	54.0	27.5	29.5	2390

TABLE 2

Original Measurements—18 Boys. Mental Age 1

AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.
	mm.	*mm.*	*kg.*	*kg.*	*kg.*	*cc.*
6	1110	610	22.8	3.0	1.0	0
7	1109	608	18.4	1.5	1.0	0
8	1230	642	23.7	0.0	0.0	0
9	1361	730	29.0	0.0	0.0	0
9	1310	680	25.2	0.0	0.0	0
10	1240	670	27.0	0.0	0.0	0
10	1161	642	23.5	0.0	0.0	0
14	1560	800	41.0	0.0	0.0	0
15	1370	721	30.7	0.0	0.0	0
16	1500	800	45.6	0.0	0.0	0
16	1400	735	38.6	0.0	0.0	0
17	1550	800	41.7	0.0	0.0	0
17	1630	850	55.3	0.0	0.0	0
17	1658	825	55.1	2.5	3.0	0
21	1480	760	35.1	0.0	0.0	0
28	1600	860	60.3	0.0	0.0	0
32	1600	850	50.5	0.0	0.0	0
39	1630	855	55.7	0.0	0.0	0

Original Measurements—48 Boys. Mental Age 2

4	976	580	15.0	4.0	3.0	0
5	1071	624	19.1	2.5	5.5	410
5	1155	647	23.0	6.5	7.0	0
9	1350	730	34.5	0.0	0.0	0
9	1248	675	27.7	0.0	0.0	0
10	1275	700	34.7	0.0	0.0	0
10	1295	680	32.0	5.0	2.0	0
10	1260	681	20.5	3.0	3.0	0
10	1343	680	27.7	2.5	4.5	300
10	1250	700	28.0	7.0	6.0	330
11	1346	699	29.0	2.0	5.0	0
12	1410	699	30.3	3.0	1.5	0
12	1390	687	30.2	3.5	4.0	0
12	1417	775	35.9	11.0	6.0	500
12	1450	744	38.9	14.0	15.0	1250
12	1331	700	32.6	0.0	0.0	0
13	1445	735	28.3	11.0	9.0	0
13	1530	755	36.0	0.0	0.0	0
14	1615	800	54.5	10.5	17.5	700
14	1364	681	35.0	7.5	4.0	0

TABLE 2—Continued

Original Measurements—48 Boys. Mental Age 2—Continued

AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.
	mm.	*mm.*	*kg.*	*kg.*	*kg.*	*cc.*
15	1524	785	40.6	12.0	11.5	700
15	1595	870	54.7	11.0	17.0	1230
16	1538	788	38.4	7.5	8.0	0
16	1533	817	46.2	7.0	7.5	295
16	1735	915	68.5	21.5	21.5	0
16	1500	805	45.0	0.0	0.0	0
17	1672	877	50.6	3.5	3.0	150
18	1700	875	59.1	0.0	0.0	0
18	1605	860	47.5	4.0	5.0	150
18	1599	832	52.4	5.0	3.0	0
18	1697	858	64.8	32.0	42.5	1545
18	1715	873	61.1	29.0	25.5	1658
19	1675	860	62.1	0.0	0.0	0
19	1760	870	62.5	7.5	7.0	0
19	1630	870	60.8	11.0	7.0	600
20	1730	913	62.2	23.0	23.5	830
21	1687	891	69.0	6.5	7.0	350
22	1730	880	63.0	17.0	20.0	600
23	1570	837	64.2	0.0	0.0	0
24	1560	845	53.7	15.0	22.5	0
26	1650	880	57.6	5.0	2.5	450
27	1578	821	51.0	21.0	12.5	600
28	1665	890	53.7	21.5	17.0	900
30	1450	730	58.7	0.0	0.0	0
31	1550	790	48.2	13.0	10.0	200
31	1745	880	61.6	24.5	12.5	200
33	1740	890	79.0	25.0	40.0	700
35	1520	810	52.4	0.0	0.0	0
	Original Measurements—32 Boys. Mental Age 3					
5	1147	635	30.9	10.0	10.0	350
8	1180	628	21.6	4.0	8.0	180
9	1250	672	30.0	8.0	7.0	0
10	1360	725	34.0	10.0	12.0	500
10	1355	745	35.2	9.0	11.0	700
10	1241	669	29.5	7.0	5.0	910
10	1321	715	29.5	6.0	10.5	250
11	1290	695	26.2	11.5	12.5	975
11	1265	672	26.7	7.0	8.0	500
13	1230	657	33.2	5.0	4.5	502

TABLE 2—Continued

Original Measurements—32 Boys. Mental Age 3—Continued

AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.
	mm.	*mm.*	*kg.*	*kg.*	*kg.*	*cc.*
13	1362	735	32.0	10.0	10.0	1170
14	1580	815	41.3	18.0	17.0	650
14	1450	765	35.4	13.5	17.0	850
15	1505	820	41.0	17.5	18.0	450
16	1745	850	47.8	20.0	19.0	210
16	1700	860	47.0	21.5	26.0	1500
16	1600	861	57.6	27.5	30.5	2020
16	1446	722	33.3	10.5	17.5	710
16	1576	807	45.2	13.5	9.0	210
17	1730	905	66.3	35.0	36.5	1460
17	1543	815	45.6	23.5	16.0	700
18	1530	821	45.6	14.5	28.0	450
19	1606	885	51.7	19.5	29.0	650
21	1748	900	76.0	34.0	31.5	2100
22	1561	740	50.4	5.0	3.5	1110
22	1650	863	61.2	20.5	25.5	1700
25	1564	860	51.6	27.0	31.0	1652
26	1882	947	73.6	45.5	48.5	1710
26	1595	855	52.5	26.5	21.5	750
31	1574	862	55.8	33.0	29.5	2053
33	1712	940	63.2	19.5	27.0	600
37	1587	862	57.2	26.2	24.0	400
	Original Measurements—26 Boys. Mental Age 4					
6	1210	658	23.9	9.5	14.5	600
10	1555	808	41.7	18.5	18.5	650
10	1439	730	42.5	7.0	5.0	620
10	1380	750	32.2	9.0	15.0	600
11	1280	680	28.4	15.0	13.0	650
11	1410	730	31.6	11.0	12.5	1165
11	1240	663	20.0	8.0	11.5	700
14	1322	680	30.3	12.0	13.5	1160
16	1607	796	48.4	12.0	21.0	1200
16	1705	875	51.0	32.5	33.5	1950
17	1660	872	56.4	22.5	28.5	1900
18	1665	845	62.0	21.0	16.0	700
18	1755	910	62.2	31.0	32.0	1700
18	1483	842	62.7	22.0	20.5	1260
20	1535	830	50.4	25.0	24.0	1160
20	1550	840	51.8	24.5	32.0	1400

TABLE 2—Continued

Original Measurements—26 Boys. Mental Age 4—Continued

AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.
	mm.	*mm.*	*kg.*	*kg.*	*kg.*	*cc.*
22	1599	830	60.6	37.0	34.5	1875
22	1788	890	55.2	12.5	8.0	1410
22	1729	875	74.6	14.5	12.0	155
23	1675	867	55.5	25.5	30.0	755
23	1485	850	50.8	26.5	21.0	600
23	1580	835	48.6	24.0	22.5	1100
25	1675	838	58.0	29.0	30.0	600
25	1620	845	53.8	29.5	20.0	900
34	1580	870	55.0	18.0	19.0	1300
39	1732	932	64.4	35.0	30.0	2400
	Original Measurements—29 Boys. Mental Age 5					
6	1105	610	19.9	6.0	7.5	400
6	1125	615	20.6	11.5	12.0	600
7	1160	635	22.7	7.0	7.5	600
10	1320	720	30.0	14.0	18.0	1280
10	1300	700	26.0	15.0	16.0	1000
12	1445	735	39.0	21.0	12.5	1020
13	1518	732	32.6	19.5	20.0	820
14	1420	728	33.0	11.0	12.0	1110
15	1355	748	32.1	17.5	17.0	1150
16	1702	877	61.1	31.0	25.0	1200
17	1700	870	77.0	31.0	27.0	1000
18	1726	900	52.1	30.0	34.5	3100
18	1601	845	60.2	31.0	31.0	1105
18	1422	783	40.3	18.5	14.0	710
18	1505	770	31.2	15.0	13.0	1350
18	1660	901	51.8	25.0	22.5	1320
19	1621	871	56.6	22.0	29.5	1018
19	1660	840	47.0	17.5	17.0	850
19	1668	895	44.0	23.0	26.0	2190
20	1584	795	45.9	20.5	23.0	490
22	1583	850	44.6	18.5	19.5	1029
23	1652	895	71.5	37.0	36.0	3690
24	1620	865	50.1	24.0	19.0	2550
26	1640	870	69.2	33.5	37.5	1320
26	1723	887	59.1	32.0	33.5	450
28	1546	788	46.6	35.5	30.0	950
31	1634	852	57.2	35.0	41.0	1690
31	1630	893	66.2	25.5	24.5	1850
40	1596	856	57.6	28.0	27.5	1630

TABLE 2—Continued

Original Measurements—46 Boys. Mental Age 6

AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.
	mm.	*mm.*	*kg.*	*kg.*	*kg.*	*cc.*
7	1270	700	28.5	10.0	12.5	975
8	1332	718	31.2	15.0	19.5	1280
8	1283	682	25.4	15.5	16.0	1300
8	1275	675	24.2	14.0	13.0	1350
9	1312	690	32.2	16.0	13.0	800
10	1249	669	24.6	14.0	15.0	1180
11	1328	720	37.0	14.0	13.0	1360
12	1530	780	39.5	16.5	20.5	1150
12	1455	776	41.6	17.0	14.5	1140
12	1388	702	31.6	15.0	18.0	1350
13	1365	728	29.9	18.0	15.0	500
13	1548	798	52.4	13.0	15.0	500
13	1332	690	26.6	13.5	12.0	1000
14	1404	780	38.2	14.0	16.0	600
14	1467	778	36.0	16.0	16.0	1000
14	1628	808	46.7	22.5	19.5	960
15	1530	810	43.8	20.0	16.0	1340
15	1454	751	32.2	19.5	22.5	1140
15	1560	794	39.9	25.5	29.0	1225
15	1661	835	52.1	32.5	26.0	2990
16	1610	860	49.6	36.0	33.5	2120
16	1710	858	55.7	20.0	23.0	900
16	1545	782	40.0	21.0	20.0	1880
17	1600	872	53.0	26.5	23.5	800
18	1635	865	54.4	31.0	36.5	3220
18	1700	875	68.1	30.0	31.5	700
18	1723	894	58.7	33.5	31.0	2735
18	1613	862	54.2	21.5	24.0	1118
18	1630	877	48.2	27.5	24.0	1650
20	1727	891	54.4	27.0	21.5	500
23	1795	908	68.4	37.5	37.0	2600
24	1665	910	69.8	30.5	37.5	1700
26	1500	810	47.1	9.0	8.5	850
27	1688	908	92.4	39.0	38.0	2800
27	1578	868	43.0	25.5	22.0	1900
28	1700	892	59.6	38.5	36.5	2800
29	1824	952	78.8	33.5	42.0	3900
30	1805	907	59.1	35.0	30.5	3010
32	1738	908	62.1	32.0	30.5	2650
32	1668	903	58.0	31.0	38.0	2170
33	1550	878	50.6	4.0	8.0	1650

TABLE 2—Continued

Original Measurements—46 Boys. Mental Age 6—Continued

AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.
	mm.	*mm.*	*kg.*	*kg.*	*kg.*	*cc.*
34	1690	901	70.2	32.0	30.0	1200
35	1610	872	57.8	40.5	37.5	3140
36	1628	862	56.6	24.8	20.0	2200
36	1525	812	47.8	25.0	27.5	1900
38	1657	895	63.6	31.0	30.0	3040

Original Measurements—41 Boys. Mental Age 7

8	1338	710	28.8	18.0	15.5	1880
9	1360	749	32.2	15.0	17.0	1130
9	1353	720	29.3	19.5	19.5	1870
10	1271	679	29.3	10.0	12.5	960
11	1350	712	28.4	14.0	11.0	400
13	1260	650	22.6	14.0	12.0	600
13	1380	698	20.1	18.5	18.5	1100
13	1480	749	34.2	17.0	19.5	500
13	1527	790	43.5	23.0	20.5	2290
13	1412	758	34.8	19.5	22.0	1270
14	1650	800	42.7	25.0	20.0	1700
14	1526	793	40.0	27.0	25.5	1590
14	1412	755	35.3	22.5	17.5	1800
15	1730	840	50.4	29.5	33.5	2190
15	1517	755	42.2	22.0	20.5	1000
16	1631	836	48.6	27.5	26.0	2920
16	1613	815	45.4	28.0	25.5	1500
16	1670	850	48.6	25.5	28.0	1500
17	1598	831	40.9	25.0	31.0	2600
19	1733	872	51.4	21.0	23.0	2250
20	1743	931	65.9	44.0	50.0	3250
21	1788	894	64.0	35.5	26.0	430
21	1820	941	82.6	55.0	50.0	3565
21	1584	850	61.4	44.0	43.0	3400
22	1700	940	68.5	49.5	48.5	3665
22	1710	885	66.0	45.0	41.1	1740
22	1616	865	47.6	36.0	38.0	2280
24	1753	908	70.2	41.0	44.0	4950
24	1704	865	54.8	40.0	37.0	3260
25	1682	902	64.6	45.0	38.0	3930
26	1700	895	65.5	32.0	26.0	3270
28	1780	870	56.4	34.0	35.5	2130

TABLE 2—Continued

Original Measurements—41 Boys. Mental Age 7—Continued

AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.
	mm.	*mm.*	*kg.*	*kg.*	*kg.*	*cc.*
29	1813	973	63.6	42.0	41.5	3080
30	1709	889	64.4	33.0	41.5	3220
30	1672	849	56.9	25.0	31.0	2260
31	1618	845	58.8	24.5	31.0	2200
31	1694	872	54.0	36.4	32.0	3100
33	1711	885	55.8	34.0	31.0	2500
38	1682	925	60.6	31.0	42.0	3300
39	1660	860	65.4	23.5	28.0	1000
40	1740	952	73.8	41.5	35.5	2310
	Original Measurements—46 Boys. Mental Age 8					
10	1429	750	34.3	21.0	19.5	840
11	1416	725	33.0	17.0	14.5	1675
11	1338	728	27.2	13.0	15.0	1100
12	1403	761	36.2	18.0	22.0	1730
12	1442	782	33.7	15.0	14.0	1800
12	1374	748	29.0	21.0	19.0	1760
13	1544	755	40.0	22.0	21.5	1565
13	1450	752	30.0	16.5	15.0	1420
13	1738	849	55.9	33.0	39.0	2350
14	1648	899	50.4	30.0	29.0	1900
14	1589	829	45.4	28.0	26.5	2760
15	1673	873	52.3	44.0	38.0	3370
15	1507	809	46.4	29.5	26.0	1050
17	1751	920	70.1	50.0	53.0	4030
17	1640	847	59.0	38.0	37.0	2100
17	1640	835	44.9	31.5	33.0	1950
17	1764	909	63.3	45.5	43.5	3000
17	1765	910	58.2	48.0	43.0	4060
18	1705	870	51.0	34.5	33.0	1400
18	1717	920	64.4	56.0	47.0	4420
19	1668	873	69.2	34.0	29.0	2520
19	1750	883	63.7	31.5	34.5	2545
19	1735	859	52.2	49.0	45.0	3050
19	1735	910	62.4	39.0	39.0	3070
19	1800	920	60.8	36.0	42.0	3100
20	1692	915	59.7	36.5	34.0	3000
20	1580	847	58.0	39.0	39.0	3000
20	1720	870	65.0	47.0	48.0	2625
21	1610	799	55.6	30.0	31.0	1790

TABLE 2—Continued

Original Measurements—46 Boys. Mental Age 8—Continued

AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.
	mm.	*mm.*	*kg.*	*kg.*	*kg.*	*cc.*
21	1570	870	65.0	44.5	43.0	2650
22	1781	920	69.9	32.5	38.0	3830
23	1623	833	49.3	28.5	31.0	2160
23	1650	877	57.7	37.5	35.0	3160
24	1820	951	95.3	40.0	39.0	3720
25	1638	846	61.9	26.0	23.5	2330
25	1680	900	61.5	42.5	38.5	2100
25	1750	853	59.4	28.5	30.5	2945
26	1660	870	52.0	25.5	28.0	1600
27	1745	908	65.7	35.0	28.5	3185
27	1759	898	60.4	33.5	27.5	2585
27	1530	825	50.0	37.0	38.0	3011
28	1756	920	59.4	40.0	34.0	3180
28	1663	938	70.8	47.0	46.0	4450
30	1555	848	52.5	35.5	32.0	2330
33	1711	930	71.8	38.0	40.0	2850
35	1670	844	77.3	33.5	32.8	2250

Original Measurements—27 Boys. Mental Age 9

9	1365	730	29.2	28.5	20.0	2000
12	1484	748	38.6	24.0	24.0	2360
15	1410	738	32.9	21.0	17.0	1950
15	1697	883	55.6	24.5	29.5	2680
15	1700	885	60.4	35.0	33.0	2850
16	1685	835	45.2	23.0	25.0	2720
17	1810	945	81.2	50.0	49.0	4400
18	1795	915	68.0	49.0	53.0	3850
18	1737	940	64.6	47.5	59.5	2925
18	1708	869	64.6	30.5	39.0	2450
19	1710	850	49.0	32.5	31.5	1680
19	1814	920	69.8	41.0	38.0	3275
19	1770	858	68.8	34.0	40.0	4300
19	1718	894	74.9	49.5	42.5	2975
20	1710	892	54.2	11.0	19.0	650
20	1715	840	48.6	20.0	21.0	1100
20	1765	940	70.8	45.5	50.0	4200
21	1772	930	69.2	41.5	47.5	3700
22	1689	860	62.0	34.0	32.5	2990
22	1740	863	69.8	39.0	41.5	2860
22	1840	910	72.2	52.0	48.0	3600

TABLE 2—Continued

Original Measurements—27 Boys. Mental Age 9—Continued

AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.
	mm.	*mm.*	*kg.*	*kg.*	*kg.*	*cc.*
23	1750	910	64.8	35.5	34.0	4100
23	1718	932	67.2	41.0	44.5	3770
24	1576	888	63.9	38.0	33.5	2400
26	1743	920	70.8	54.0	48.5	2830
27	1730	913	74.2	39.5	31.5	3265
37	1658	885	71.3	40.5	38.0	2980

Original Measurements—20 Boys. Mental Age 10

13	1502	789	53.0	32.5	32.5	1710
14	1595	804	42.9	15.5	20.0	2490
15	1665	862	49.3	33.5	35.0	2600
15	1478	757	39.7	24.5	23.0	1950
15	1702	879	60.0	45.5	45.0	3895
16	1794	939	74.4	55.0	52.5	3710
17	1640	850	47.0	32.0	30.0	2730
17	1628	838	54.8	26.0	31.5	3100
17	1710	888	56.7	34.5	34.5	2430
17	1646	853	52.1	40.0	37.0	3120
19	1680	883	48.3	38.0	43.0	2200
20	1709	898	64.5	25.0	25.0	1850
21	1645	850	63.4	32.5	32.5	3350
21	1732	930	66.8	52.5	44.5	2580
22	1720	862	53.8	40.0	39.0	3160
22	1700	929	59.8	46.0	45.0	3440
23	1649	882	53.5	20.5	22.5	3220
23	1801	930	69.8	46.0	41.0	4010
27	1912	980	69.0	42.5	52.5	2980
29	1700	888	71.5	42.0	47.0	3545

Original Measurements—3 Boys. Mental Age 11

16	1810	928	69.0	46.0	40.5	3955
17	1773	926	78.5	39.5	44.5	5030
37	1695	855	63.0	32.0	27.0	3100

TABLE 3

Percentiles of Measurements—9 Girls. Mental Age 1

AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.	PHYS. AV.	PS. PH. AV.	TOTAL AV.	PHYS. EXCESS
8	8	− 2	0	−20	−16	−11	2	−16	− 7	18
11	5	. 0	6	−20	−26	−33	4	−26	−11	30
11	76	86	100	−10	−23	−33	87	−22	33	109
12	20	7	31	−18	− 9	−13	19	−13	3	32
15	10	10	24	−13	−19	−40	15	−24	− 5	39
16	10	7	11	−36	−21	−24	9	−27	− 9	36
18	4	− 5	− 5	−21	−23	−32	− 2	−25	−14	23
19	0	0	0	−25	−45	−50	0	−40	−20	40
25	1	4	11	−18	−32	−14	5	−21	− 8	26
Av.....14.9	14.7	11.8	19.6	−19.9	−23.5	−27.5	15.3	−23.5	− 4.2	38.8
m.v..... 4.2	14.6	16.2	21.0	4.7	6.9	10.8	16.5	5.2	9.8	14.3
c.v..... 0.28	0.99	1.37	1.09	0.23	0.29	0.35	1.07	0.22	2.36	0.36
No. N.....	1	1	1	0	0	0	1	0	0	0

Percentiles of Measurements—29 Girls. Mental Age 2

5	98	98	100	10	30	−60	99	− 7	46	106
6	64	69	80	−13	−16	−30	71	−20	26	91
6	66	20	80	−13	−16	−30	55	−20	18	75
7	5	0	11	−16	−11	−50	5	−26	−11	31
7	58	46	63	− 6	− 3	−50	56	−20	18	76
8	0	−25	0	−10	−16	−12	− 8	−13	−11	5
9	− 3	3	21	−10	8	−12	7	− 5	1	12
10	9	5	9	− 6	3	− 5	8	− 3	3	11
10	34	14	23	−16	− 7	−20	24	−14	5	38
12	60	76	67	−25	−12	−13	68	−16	26	84
12	5	4	4	−18	− 5	−13	4	−12	− 4	16
13	−15	− 6	− 5	−14	−15	−39	− 9	−23	−16	14
13	7	9	50	7	5	−27	22	− 5	9	27
13	9	15	9	− 7	− 6	−16	11	−10	1	21
14	9	7	21	−14	− 4	−30	12	−16	− 2	28
15	57	26	33	−13	−10	−41	39	−21	9	60
16	14	8	55	−14	0	−24	26	−16	5	42
17	5	2	9	−15	−13	−20	5	−16	− 6	21
17	7	10	5	−14	−14	−19	7	−16	− 5	23
18	− 3	− 4	8	−38	−37	−23	0	−33	−17	33
19	0	10	8	− 5	5	−23	6	− 8	− 1	14
21	6	1	20	−74	−52	−17	9	−48	−20	57
24	8	12	16	−18	−30	−13	12	−20	− 4	32
24	26	34	79	−22	0	−14	46	−11	18	57
25	8	7	8	−18	−30	−13	8	−20	− 6	28
29	8	4	60	−18	−30	−13	34	−20	7	54
30	5	6	10	−10	−30	−13	7	−15	− 4	22
32	27	16	90	−13	−12	−10	44	−12	16	56
37	9	9	78	−18	−30	−13	32	−20	6	53
Av.....16.4	20.4	16.6	34.8	−15.4	−12.1	−23.2	24.1	−17.0	3.7	40.9
m.v..... 6.9	21.7	17.8	29.2	8.0	12.1	10.7	20.7	6.1	10.9	21.2
c.v..... 0.42	1.06	1.07	0.84	0.52	1.0	0.46	0.85	0.36	2.95	0.51
No. N.....	6	3	11	0	0	0	5	0	0	0

TABLE 3—CONTINUED

Percentiles of Measurements—15 Girls. Mental Age 3

AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.	PHYS. AV.	PS. PH. AV.	TOTAL AV.	PHYS. EXCESS
7	9	20	31	0	30	−50	20	− 7	7	27
8	− 9	−12	− 6	− 4	1	− 3	− 9	− 2	− 6	7
10	14	27	20	− 3	3	− 8	20	− 3	9	23
10	5	1	10	−10	− 5	−20	5	−12	− 3	17
10	91	84	90	− 8	6	−16	88	− 6	41	94
11	17	9	9	9	50	−18	12	14	13	− 2
12	90	90	91	50	78	− 9	90	39	65	51
14	6	8	9	−10	− 8	−17	7	−12	− 2	19
15	3	7	10	3	4	−27	7	− 7	0	14
16	55	50	36	− 6	8	−22	47	− 7	20	54
16	59	62	22	4	2	−15	48	− 3	23	51
17	68	11	96	1	17	− 9	58	3	30	55
22	88	62	42	− 3	−12	− 7	64	− 7	29	71
27	8	4	2	−16	−26	−10	5	−13	− 4	18
29	4	2	7	− 8	−21	− 4	4	−11	− 4	15
Av.....14.7	33.7	28.0	30.9	− 0.1	8.3	−15.5	31.7	− 2.2	14.5	34.2
m.v..... 4.9	32.6	27.1	26.0	9.1	17.8	7.9	27.9	8.4	15.5	22.7
c.v..... 0.33	0.96	0.96	0.84	13.00	2.14	0.51	0.88	3.36	1.09	0.66
No. N.....	6	5	3	1	2	0	4	0	1	1

Percentiles of Measurements—10 Girls. Mental Age 4

9	0	−12	0	−13	−13	−22	− 4	−16	−10	12
11	4	− 7	2	3	3	−17	0	− 4	− 2	4
11	7	0	6	0	− 6	−18	4	− 8	− 2	12
11	46	40	65	40	60	0	50	33	42	17
14	31	42	60	−12	− 9	−35	44	−19	12	63
16	− 1	7	3	− 4	0	−12	3	− 5	− 1	8
16	18	10	65	8	5	9	31	7	19	24
16	6	8	5	−17	− 4	−10	6	−10	− 2	16
18	4	9	21	8	3	−26	11	− 5	3	16
23	− 8	16	82	6	− 5	−13	30	− 4	13	34
Av.....14.5	10.7	11.3	30.9	1.9	3.4	−14.4	17.5	− 3.1	7.2	20.6
m.v..... 3.3	12.6	12.8	29.7	11.1	11.6	9.2	17.0	8.7	11.6	11.8
c.v..... 0.23	1.18	1.13	0.96	5.84	3.42	0.81	0.97	2.55	1.61	0.57
No. N.....	0	0	4	0	1	0	1	0	0	0

TABLE 3—CONTINUED

Percentiles of Measurements—15 Girls. Mental Age 5

AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.	PHYS. AV.	PS. PH. AV.	TOTAL AV.	PHYS. EXCESS
8	27	54	42	80	50	8	41	46	43	− 5
8	4	1	3	6	6	− 5	3	2	3	1
9	83	77	91	30	83	− 4	83	36	60	47
10	6	13	4	5	20	0	8	8	8	0
13	28	27	23	0	13	−13	26	0	13	26
13	63	51	86	− 4	2	− 7	66	− 3	32	69
14	8	17	40	− 6	15	− 4	22	2	12	20
14	17	10	12	6	5	−16	13	− 2	6	15
15	6	10	70	6	20	−12	29	5	17	24
20	12	9	97	− 7	− 3	− 5	39	− 5	17	44
21	26	9	57	30	30	2	31	21	26	10
22	9	9	70	5	0	0	29	2	16	27
25	9	1	8	2	8	− 2	6	3	5	3
28	9	19	32	− 1	6	5	20	3	12	17
30	70	15	60	15	30	2	48	16	32	32
Av.....16.7	25.0	21.5	46.3	11.1	19.0	− 3.4	30.9	8.9	20.1	22.0
m.v..... 0.6	19.5	16.5	27.6	14.7	15.9	5.0	15.5	11.8	12.9	13.7
c.v..... 0.37	0.78	0.77	0.59	1.31	0.84	1.47	0.50	1.33	0.60	0.62
No. N.....	3	3	7	1	2	0	2	0	1	2

Percentiles of Measurements—13 Girls. Mental Age 6

9	84	77	72	25	65	8	78	33	55	43
9	103	95	92	94	98	9	97	67	82	30
12	74	80	88	40	37	46	81	41	61	40
14	26	22	34	30	65	0	27	32	30	− 5
14	10	9	21	−10	− 7	−23	13	−13	0	26
15	40	46	68	43	7	10	51	20	36	31
18	70	57	64	35	15	− 6	64	15	23	49
20	5	7	9	− 6	− 1	−10	7	− 6	1	13
21	53	19	73	15	25	5	48	15	32	33
27	8	37	70	10	7	8	38	8	23	30
30	10	5	15	−13	−10	− 8	10	−10	0	20
31	7	44	108	3	− 5	− 4	53	− 2	26	55
38	52	40	59	− 6	0	− 4	50	− 3	24	53
Av.....19.7	41.7	41.5	59.5	20.0	22.8	1.6	47.3	15.0	31.6	32.2
m.v..... 7.4	28.6	23.2	24.6	22.8	27.1	11.0	21.8	18.0	18.0	12.5
c.v..... 0.38	0.69	0.56	0.41	1.13	1.19	6.88	0.46	1.20	0.57	0.39
No. N.....	6	4	9	1	3	0	7	1	3	0

TABLE 3—CONTINUED

Percentiles of Measurements—23 Girls. Mental Age 7

AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.	PHYS. AV.	PS. PH. AV.	TOTAL AV.	PHYS. EXCESS
9	85	55	63	91	94	52	68	79	74	−11
9	9	13	10	65	40	− 5	11	33	22	−22
9	64	45	70	90	50	35	60	58	59	2
10	41	65	50	70	70	2	52	47	50	5
11	72	90	88	87	85	75	83	82	83	1
12	110	91	92	95	92	58	98	82	90	16
12	17	34	16	20	32	26	22	26	24	− 4
13	57	67	91	8	10	11	71	10	43	65
14	100	91	90	50	70	101	94	74	84	20
14	39	47	26	33	86	87	37	69	53	−32
18	12	9	46	5	10	− 4	22	4	13	18
18	23	28	27	− 3	− 5	−28	26	−12	7	38
19	37	8	82	0	−13	−39	42	−17	13	59
24	18	25	95	13	65	0	46	26	36	20
24	0	7	− 4	− 8	−18	−11	1	−12	− 6	13
26	10	12	8	8	10	6	10	8	9	2
27	73	41	82	8	15	30	65	18	42	48
28	13	−10	2	− 2	9	0	2	2	2	0
28	50	44	26	6	5	− 3	40	3	21	37
28	60	43	30	8	8	−12	44	1	23	43
30	79	93	82	2	35	84	85	40	63	45
36	73	10	50	30	85	2	44	39	42	5
38	42	12	120	10	55	6	58	24	41	34
Av.....20.3	47.1	40.0	54.0	30.0	39.0	20.6	47.0	29.7	38.6	17.4
m.v..... 7.9	26.5	25.0	36.8	30.3	31.5	31.6	23.3	26.6	22.6	20.4
c.v..... 0.40	0.56	0.63	0.68	1.01	0.81	1.53	0.48	0.90	0.59	1.17
No. N.....	11	7	13	7	10	6	10	6	8	5

Percentiles of Measurements—9 Girls. Mental Age 8

13	44	47	76	7	4	5	56	5	31	51
13	55	37	43	6	− 4	5	45	2	24	43
13	76	52	71	30	35	9	66	25	46	41
17	94	90	90	50	77	0	91	42	67	49
21	12	9	67	9	7	4	29	6	18	23
24	9	54	82	4	− 2	7	48	3	26	45
25	9	9	31	7	5	0	16	4	10	12
32	8	16	20	9	30	0	15	13	14	2
37	7	9	94	5	22	− 4	37	8	22	29
Av.....21.4	34.5	35.5	63.1	14.0	19.1	2.8	44.7	11.9	28.7	32.7
m.v..... 6.8	28.5	22.2	21.6	11.3	19.0	3.4	17.8	9.7	12.5	14.2
c.v..... 0.31	0.82	0.62	0.34	0.81	0.99	1.21	0.39	0.81	0.43	0.43
No. N.....	3	3	6	1	1	0	3	0	1	0

TABLE 3—Continued

Percentiles of Measurements—12 Girls. Mental Age 9

AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.	PHYS. AV.	PS. PH. AV.	TOTAL AV.	PHYS. EXCESS
12	82	50	71	90	92	87	68	89	78	−21
18	40	40	37	9	15	18	39	11	25	28
19	47	64	90	91	75	45	67	74	72	− 7
19	94	90	95	8	48	75	93	44	69	49
19	91	81	72	60	45	35	81	47	64	34
22	20	35	37	20	70	10	31	33	32	− 2
23	53	48	18	9	10	12	40	10	25	30
25	26	23	42	70	50	8	30	43	37	−13
30	30	60	10	3	− 7	− 3	33	− 2	16	35
31	20	8	6	4	7	25	11	12	12	− 1
31	8	9	42	7	15	9	20	10	15	10
36	9	15	90	7	1	4	38	4	21	34
Av.....23.6	43.1	43.4	50.6	31.3	34.9	26.9	45.8	31.2	38.6	14.5
m.v..... 5.6	24.9	46.7	27.1	30.6	27.3	22.1	20.5	23.9	20.9	20.3
c.v..... 0.24	0.57	1.07	0.53	0.97	0.89	0.82	0.45	0.76	0.54	1.40
No. N.....	4	5	5	4	4	2	4	2	4	5

Percentiles of Measurements—5 Girls. Mental Age 10

24	70	50	74	6	17	5	65	9	37	56
24	70	45	92	40	8	81	69	43	56	26
27	18	21	69	3	32	2	36	12	24	14
31	8	64	78	55	90	3	50	49	50	1
34	30	72	70	54	53	4	57	37	47	20
Av.....28.0	39.2	50.4	76.6	31.6	40.0	19.0	55.4	30.0	42.8	25.4
m.v..... 3.6	24.6	14.1	6.8	21.6	25.2	24.8	10.3	15.7	10.2	12.2
c.v..... 0.13	0.62	0.26	0.09	0.68	0.63	1.30	0.18	0.52	0.23	0.48
No. N.....	2	3	5	2	2	1	4	0	2	0

Percentiles of Measurements—1 Girl. Mental Age 11

17	72	64	70	30	65	55	69	50	60	19

TABLE 4.

Percentiles of Measurements—18 Boys. Mental Age 1

AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.	PHYS. AV.	PS. PH. AV.	TOTAL AV.	PHYS. EXCESS
6	30	15	83	−10	−10	−35	43	−18	13	61
7	8	5	6	− 8	−10	−24	6	−14	− 4	20
8	50	10	66	−22	−35	−27	42	−28	7	70
9	88	87	70	−22	−17	−23	82	−21	31	103
9	66	36	25	−22	−17	−23	42	−21	11	63
10	0	8	7	−33	−20	−20	5	−24	−10	29
10	7	9	21	−33	−20	−20	12	−24	− 6	36
14	55	48	34	−25	−28	−18	46	−24	11	70
15	3	6	0	−11	−19	−19	3	−16	7	19
16	− 2	1	3	−15	−16	−30	1	−20	−10	21
16	6	9	10	−15	−16	−30	8	−20	− 6	28
17	17	14	31	−13	−13	−15	21	−14	3	35
17	28	9	30	−11	−11	−14	22	−12	5	34
17	8	5	5	−17	−13	−14	6	−15	− 5	21
21	0	−12	−20	−74	−53	−23	−11	−50	−30	39
28	8	10	41	−74	−53	−23	20	−50	−15	70
32	8	8	5	−74	−53	−23	7	−50	−22	57
39	10	9	23	−73	−53	−23	14	−50	−18	64
Av.....16.0	21.6	15.4	24.4	−30.7	−25.4	−22.4	20.5	−26.2	− 2.9	46.7
m.v..... 6.3	20.8	13.3	20.4	20.3	13.6	4.1	17.2	10.8	11.3	20.4
c.v..... 0.39	0.96	0.86	0.83	0.66	0.53	0.18	0.84	0.41	3.89	0.43
No. N.....	4	1	3	0	0	0	1	0	0	0

TABLE 4—Continued

Percentiles of Measurements—48 Boys. Mental Age 2

AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.	PHYS. AV.	PS. PH. AV.	TOTAL AV.	PHYS. EXCESS
4	15	34	13	2	10	−50	21	−13	4	34
5	95	90	93	20	30	−55	93	− 2	46	95
5	44	68	67	−15	17	−24	66	− 7	30	73
9	84	87	94	−23	−18	−23	95	−21	37	116
9	23	20	55	−23	−18	−23	33	−21	6	54
10	16	30	90	−33	−20	−20	45	−24	11	69
10	25	10	75	−16	−15	−20	36	−17	10	53
10	10	11	4	−24	−13	−20	8	−19	− 6	27
10	60	10	30	−27	− 8	−13	33	−16	9	49
10	9	30	33	−23	− 5	−13	24	−14	5	38
11	33	15	21	−25	−16	−36	13	−26	− 7	39
12	5	6	13	− 9	− 8	−25	8	−14	− 3	22
12	10	9	22	−14	−15	−30	14	−19	− 3	33
12	44	8	16	−10	−23	−26	23	−19	2	42
12	48	81	44	1	− 5	−15	58	− 6	26	64
12	67	44	75	6	10	2	63	6	35	57
13	30	10	0	− 4	0	−50	13	−18	− 3	31
13	70	30	17	−22	−13	−50	39	−28	6	67
14	5	−36	10	−13	−20	−18	− 7	−17	−12	10
14	80	48	88	− 8	7	− 8	72	− 2	35	74
15	7	15	13	− 2	− 4	− 9	12	− 5	4	17
15	42	74	71	− 3	2	− 2	62	− 1	31	63
16	9	7	3	2	− 8	−30	6	−12	− 3	18
16	8	13	12	− 8	−10	−25	11	−14	− 2	25
16	5	9	9	−13	−16	−30	8	−30	−11	38
16	81	85	90	3	6	−30	92	− 7	43	99
17	36	30	13	−10	−10	−14	26	−11	8	37
18	38	14	34	−11	−17	−11	29	−13	8	42
18	− 4	0	8	−60	−65	−33	1	−53	−26	54
18	32	16	37	−63	−27	−33	28	−41	− 7	69
18	− 1	9	2	−64	−62	−30	3	−52	−25	55
18	31	2	60	− 8	34	−12	31	5	18	26
19	9	15	42	−52	−42	−16	22	−37	− 8	59
19	70	15	48	−59	−42	−23	44	−41	2	85
19	5	10	46	−73	−53	−23	20	−50	−15	70
20	52	53	47	−28	−14	−14	51	−19	16	70
21	28	32	73	−61	−42	−19	44	−41	2	85
22	52	18	50	−40	−20	−16	40	−25	8	65
23	5	5	52	−74	−54	−23	21	−50	−16	71
24	5	7	10	−44	−16	−23	7	−28	−11	35
26	19	18	31	−64	−49	−18	23	−43	−10	66
27	6	2	5	−32	−33	−16	4	−27	−12	31
28	23	31	10	−31	−25	−13	21	−23	− 1	44
30	− 2	−20	35	−74	−54	−23	4	−50	−23	54
31	4	− 6	0	−48	−37	−21	− 1	−35	−18	34
31	63	18	45	−25	−33	−20	42	−26	8	68
33	60	31	92	−24	20	−15	61	− 6	28	67
35	3	− 1	8	−74	−53	−23	4	−50	−23	46
Av.....17.0	30.6	22.9	37.9	−27.4	−18.2	−22.5	30.6	−22.8	3.9	53.3
m.v..... 5.8	22.0	41.2	25.5	20.8	17.4	8.2	20.2	12.7	13.5	18.5
c.v..... 0.34	0.72	1.80	0.67	0.76	0.96	0.36	0.66	0.56	3.46	0.35
No. N.....	12	7	16	0	0	0	10	0	0	0

TABLE 4—Continued

Percentiles of Measurements—32 Boys. Mental Age 3

AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.	PHYS. AV.	PS. PH. AV.	TOTAL AV.	PHYS. EXCESS
5	94	84	108	70	83	−30	95	41	68	54
8	18	6	12	−10	5	−22	12	− 9	2	21
9	24	18	80	0	0	−23	41	− 8	17	49
10	8	9	50	−10	− 8	0	22	− 6	8	28
10	42	52	50	−13	− 6	−14	48	−11	19	59
10	66	89	90	− 3	− 8	− 4	80	− 5	38	85
10	69	68	88	0	10	− 9	75	0	36	75
11	10	12	9	1	8	− 5	10	1	5	9
11	8	7	9	−10	− 6	−20	8	−12	− 2	20
13	6	10	8	− 5	0	−11	8	− 5	2	13
13	−10	−10	10	−14	− 8	−34	− 3	−19	−11	16
14	15	20	11	− 3	6	− 5	15	− 1	7	16
14	65	62	36	5	6	− 8	54	1	28	53
15	13	39	14	3	3	−13	22	− 2	10	24
16	14	8	10	− 3	− 7	−27	11	−12	− 1	23
16	87	30	16	2	3	−27	44	− 7	19	51
16	23	40	62	8	19	3	42	10	26	32
16	2	0	− 2	− 5	1	−19	0	−23	−12	23
16	67	40	15	3	10	− 5	41	3	22	38
17	7	8	8	2	− 1	− 9	8	− 3	3	11
17	75	56	81	10	25	− 2	71	11	41	60
18	−16	− 3	0	−23	− 7	−20	− 6	−17	−12	11
19	8	23	6	−35	−21	−16	12	−24	− 6	36
21	68	38	90	− 6	− 1	− 1	65	− 3	31	68
22	5	−16	4	−64	−53	−11	− 2	−43	−23	41
22	18	12	46	−34	−11	− 5	25	−17	4	42
25	− 2	5	− 9	−11	− 3	−37	− 2	−17	−10	15
26	7	9	8	−21	−17	−15	8	−18	− 5	26
26	93	80	87	18	53	− 5	87	22	55	65
31	6	12	23	− 8	− 4	− 1	14	− 4	5	18
33	42	77	49	−35	− 9	−17	56	−20	18	76
37	7	12	29	−22	−15	−19	16	−19	− 2	35
Av.....16.9	29.1	27.8	34.0	− 7.1	1.4	−13.5	30.2	− 6.7	11.7	37.0
m.v... .. 5.6	27.5	24.4	29.1	13.4	13.2	8.4	24.8	10.4	16.3	18.1
c.v..... 0.33	0.95	0.88	0.87	1.89	9.43	0.62	0.82	1.55	1.39	0.49
No. N.....	9	8	10	1	2	0	8	0	2	0

TABLE 4—Continued

Percentiles of Measurements—26 Boys. Mental Age 4

AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.	PHYS. AV.	PS. PH. AV.	TOTAL AV.	PHYS. EXCESS
6	91	80	90	25	94	− 5	87	38	63	49
10	112	108	95	65	75	− 6	105	45	75	60
10	94	74	94	−10	− 8	− 6	87	− 8	40	95
10	80	91	77	− 3	40	− 7	83	10	47	73
11	5	5	1	− 8	5	−13	4	− 5	− 1	9
11	9	8	17	10	10	−16	11	1	6	10
11	73	50	44	0	8	2	56	3	30	53
14	1	− 4	5	− 5	− 1	− 1	1	− 2	− 1	3
16	70	50	31	16	28	3	50	16	33	34
16	26	8	19	− 4	5	−10	18	− 3	8	21
17	29	26	36	4	7	1	30	4	17	26
18	13	3	39	−30	−37	−23	19	−30	− 6	49
18	−26	3	43	−28	−17	−16	7	−20	− 7	27
18	64	37	39	−10	3	− 8	47	− 5	21	52
20	4	7	7	−25	0	− 8	6	−11	− 3	17
20	4	4	5	− 4	−13	−10	4	− 9	− 3	13
22	80	31	22	−50	−40	− 7	44	−32	6	76
22	7	3	44	0	4	− 3	18	0	9	18
22	50	16	89	−25	−33	−21	52	−26	13	78
23	9	8	5	−21	−18	−17	7	−19	− 6	26
23	25	13	23	−23	− 3	−15	20	−14	3	34
23	6	5	2	−26	−16	−11	4	−18	− 7	22
25	25	6	33	−14	− 4	−17	21	−11	5	32
25	9	7	10	−15	−20	−13	9	−16	− 4	27
34	6	15	21	−38	−22	− 9	14	−23	−10	37
39	54	73	45	− 4	− 3	2	57	− 2	28	59
Av.....18.3	34.9	27.6	35.5	− 8.4	1.2	− 8.8	32.7	− 5.2	13.5	38.0
m.v..... 5.7	31.4	26.0	23.7	15.5	19.8	5.5	25.1	12.4	17.5	19.6
c.v..... 0.31	0.90	0.97	0.67	1.85	16.50	0.63	0.77	2.38	1.29	0.50
No. N.....	10	7	5	1	2	0	8	0	2	0

TABLE 4—Continued

Percentiles of Measurements—29 Boys. Mental Age 5

AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.	PHYS. AV.	PS. PH. AV.	TOTAL AV.	PHYS. EXCESS
6	42	22	52	70	83	− 5	39	49	44	−10
6	26	15	37	3	15	−15	26	1	14	25
7	28	18	55	5	6	− 3	34	3	19	31
10	28	30	14	23	50	2	24	25	25	− 1
10	40	60	57	17	70	8	52	32	42	20
12	30	10	52	20	3	−16	31	2	17	29
13	66	10	9	13	30	−13	28	10	19	18
14	8	5	7	− 7	− 4	− 2	7	− 4	2	11
15	2	8	2	3	3	− 3	4	1	3	3
16	68	51	77	12	9	−10	65	4	35	61
17	66	46	96	7	6	− 7	69	2	36	67
18	− 3	5	30	−10	0	−18	11	− 9	1	20
18	42	28	8	−12	8	8	26	1	14	25
18	−49	−14	− 7	−35	−43	−34	−23	−37	−30	14
18	10	30	7	−22	−21	−13	16	−19	− 2	35
18	−21	−17	−17	−42	−45	−14	−18	−34	−26	16
19	22	6	− 2	−38	−15	−14	9	−22	− 6	31
19	9	15	27	−30	− 4	−12	17	−15	1	32
19	24	35	− 6	−28	−10	0	18	−13	3	31
20	8	−43	− 3	−33	−15	−17	−13	−22	−18	9
22	6	7	− 5	−37	−22	−12	3	−24	−11	27
23	20	35	83	0	7	42	46	16	31	30
24	9	13	4	−26	−22	5	9	−14	− 3	23
26	12	15	74	− 7	9	− 9	34	− 2	16	36
26	47	27	38	−10	2	−18	37	− 9	14	46
28	4	− 6	− 2	− 3	− 3	−12	− 1	− 6	− 4	5
31	10	8	28	− 4	25	− 5	15	5	10	10
31	10	33	59	−23	−13	− 3	34	−13	11	47
40	7	10	30	−18	− 9	− 6	16	−11	3	27
Av.....18.4	19.7	15.7	27.7	− 7.2	3.4	− 6.6	21.1	− 3.6	8.8	24.4
m.v..... 5.6	18.8	15.1	26.2	18.1	18.8	8.5	17.2	13.7	14.4	12.5
c.v..... 0.30	0.95	0.96	0.96	2.51	5.53	1.29	0.83	3.81	1.64	0.51
No. N.....	3	2	9	1	3	0	3	1	0	2

TABLE 4—Continued

Percentiles of Measurements—46 Boys. Mental Age 6

AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.	PHYS. AV.	PS. PH. AV.	TOTAL AV.	PHYS. EXCESS
7	75	80	89	10	45	5	81	20	51	61
8	92	92	90	70	95	36	91	67	79	24
8	81	59	61	77	83	40	67	66	67	1
8	78	48	48	55	50	50	58	52	55	6
9	68	40	90	70	30	− 1	66	33	50	33
10	9	10	10	17	40	9	10	22	16	−12
11	22	36	87	8	10	8	48	9	29	39
12	69	82	85	10	9	0	79	6	43	73
12	92	85	76	9	55	0	84	21	53	63
12	33	9	21	7	30	4	21	14	18	7
13	79	72	91	0	7	−34	81	− 9	36	90
13	2	−17	− 3	0	3	−16	− 6	− 4	− 5	− 2
13	6	7	4	8	7	−33	6	− 6	0	12
14	81	55	86	35	25	−18	74	14	44	60
14	7	31	24	− 2	4	−10	21	− 3	9	24
14	20	30	13	2	4	− 3	21	1	11	20
15	18	30	22	5	1	− 1	23	2	13	21
15	71	49	59	41	20	59	60	40	50	20
15	29	19	10	10	35	− 2	19	14	17	5
15	8	0	40	4	9	− 4	16	3	10	13
16	25	40	25	30	28	5	30	21	26	9
16	71	38	51	2	7	−15	53	− 2	26	55
16	10	7	5	3	4	1	7	3	5	4
17	10	26	19	4	3	− 8	18	0	9	18
18	5	10	10	−10	− 4	11	8	− 1	4	9
18	4	16	3	−17	−18	−11	8	−15	− 4	23
18	42	25	26	− 5	0	4	31	0	15	31
18	0	9	10	−29	−17	−18	6	−21	− 8	27
18	32	15	82	−12	1	−23	43	−11	16	54
20	50	32	16	−20	−16	−17	33	−18	8	51
23	82	47	70	1	8	6	66	5	36	61
24	23	50	77	−13	9	− 6	50	− 3	24	53
26	1	0	0	−56	−37	−14	0	−36	−18	36
27	28	47	97	4	10	7	57	7	32	50
27	6	14	− 7	−23	−17	− 3	4	−14	− 5	18
28	33	22	39	3	7	7	31	6	19	25
29	88	83	92	− 7	30	56	88	26	57	62
30	84	46	37	− 4	− 3	9	56	1	29	55
32	60	47	46	−10	− 3	5	51	− 3	24	54
32	23	40	32	−12	10	0	31	− 1	15	32
33	4	18	5	−66	−45	− 6	9	−39	−15	48
34	28	38	80	−10	− 3	−10	49	− 8	21	57
35	9	16	31	7	9	12	19	9	14	10
36	3	0	0	−14	− 8	− 3	1	− 8	− 4	9
36	9	12	28	−24	−20	1	16	−14	1	30
38	20	35	50	−12	− 3	9	35	− 2	16	37
Av.....19.6	36.8	33.7	41.8	3.2	10.8	1.9	37.4	5.3	21.0	31.9
m.v..... 7.6	27.8	20.1	29.0	18.3	18.6	13.2	24.4	15.2	18.2	19.4
c.v..... 0.39	0.76	0.59	0.69	5.72	1.72	6.95	0.65	3.00	0.86	0.60
No. N.....	16	9	18	4	4	3	17	3	8	2

TABLE 4—Continued

Percentiles of Measurements—41 Boys. Mental Age 7

AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.	PHYS. AV.	PS. PH. AV.	TOTAL AV.	PHYS. EXCESS
8	93	90	90	90	80	94	91	88	90	3
9	85	87	73	87	90	90	82	89	86	− 7
9	88	93	91	40	77	8	91	42	67	49
10	14	10	48	0	15	1	24	5	15	19
11	35	25	25	7	3	−20	28	− 3	13	31
13	8	0	4	9	17	−13	4	4	4	0
13	70	67	73	40	35	50	70	42	56	28
13	14	32	18	12	45	− 8	21	16	19	5
13	48	22	15	7	25	−33	28	0	14	28
13	− 5	−12	−11	2	3	−30	− 9	− 8	− 9	− 1
14	86	47	43	35	15	8	59	19	39	40
14	8	13	10	20	7	9	10	12	11	− 2
14	41	42	30	45	45	6	38	32	35	6
15	91	52	51	28	55	12	65	32	49	33
15	15	8	17	7	7	− 5	13	3	8	10
16	40	30	20	6	14	− 5	30	5	18	25
16	28	16	10	8	10	− 5	18	4	11	14
16	34	20	20	7	10	28	25	15	20	10
17	9	9	4	3	8	7	7	6	7	1
19	57	16	6	−32	−15	1	26	−15	6	41
20	62	73	58	15	60	18	64	31	48	33
21	6	8	45	15	32	26	20	24	22	− 4
21	80	35	52	− 5	−10	−19	56	−11	23	67
21	88	77	93	58	60	34	86	51	68	35
22	41	23	58	18	5	− 4	41	6	24	35
22	33	77	71	38	52	40	60	43	52	17
22	9	13	32	− 2	10	1	18	3	11	15
24	40	13	20	6	8	8	24	7	16	17
24	67	47	80	8	35	91	65	45	55	20
25	26	40	54	17	10	53	40	27	34	13
26	32	36	57	−10	−10	20	42	0	21	42
28	78	15	26	− 6	− 6	0	40	− 4	18	44
29	86	92	50	10	28	10	76	16	46	60
30	25	8	28	−24	− 2	1	20	− 8	6	28
30	40	30	53	− 8	27	17	41	13	27	28
31	8	7	35	−25	− 2	0	17	− 9	4	26
31	30	15	13	− 1	0	10	19	3	11	16
33	42	23	24	− 6	− 2	4	30	1	16	29
38	27	70	76	−12	30	20	58	13	36	45
39	22	10	57	−27	− 6	−12	30	−15	8	45
40	60	84	88	9	6	2	77	6	42	71
Av.....20.6	43.0	35.7	41.7	12.0	21.2	12.8	40.1	15.5	27.8	24.7
m.v..... 7.1	23.9	24.5	23.3	18.5	21.2	19.7	21.6	18.0	17.7	15.5
c.v..... 0.34	0.56	0.69	0.56	1.54	1.00	1.54	0.54	1.16	0.64	0.64
No. N.....	14	11	18	3	7	5	14	3	7	5

TABLE 4—Continued

Percentiles of Measurements—46 Boys. Mental Age 8

AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.	PHYS. AV.	PS. PH. AV.	TOTAL AV.	PHYS. EXCESS
10	90	91	89	85	85	8	90	59	75	31
11	27	47	10	5	20	0	25	8	17	17
11	76	42	58	30	17	33	59	27	43	32
12	26	49	8	40	40	26	28	35	32	− 7
12	63	87	41	7	9	30	64	15	35	49
12	40	65	59	20	70	23	55	38	47	17
13	33	26	4	6	7	− 3	21	3	12	18
13	77	28	51	30	80	2	52	37	45	15
13	100	91	92	90	94	70	94	85	90	9
14	69	72	56	50	53	70	66	58	62	8
14	86	93	77	60	65	12	85	46	66	39
15	34	75	60	83	69	79	56	77	67	−21
15	13	30	30	26	20	− 5	24	14	19	10
17	19	13	50	17	26	3	27	15	21	12
17	88	60	80	50	52	15	76	39	58	37
17	9	10	7	7	13	2	9	7	8	2
17	87	60	46	57	50	81	64	63	64	1
17	83	74	88	74	90	80	82	81	82	1
18	39	45	56	75	53	84	47	71	59	−24
18	34	12	6	− 3	5	−14	17	− 4	7	21
19	57	10	8	37	47	9	25	31	28	− 6
19	23	16	74	− 6	− 5	4	34	− 2	16	36
19	83	60	42	− 2	30	10	62	13	38	49
19	56	50	47	4	15	9	51	9	30	42
19	66	20	51	−11	4	4	43	− 1	21	44
20	46	15	55	30	50	5	39	28	34	11
20	6	7	32	4	15	10	15	10	13	5
20	30	55	40	− 1	6	9	42	5	24	37
21	8	− 3	23	−14	− 2	− 4	9	− 7	1	16
21	6	15	55	16	32	5	25	18	22	7
22	48	60	79	− 9	10	50	62	17	40	45
23	9	4	3	−17	− 2	0	5	− 7	− 1	12
23	18	17	31	1	5	13	22	6	14	16
24	88	82	99	6	15	44	96	22	59	74
25	65	9	28	− 7	− 3	8	34	− 1	17	35
25	10	7	45	−22	−14	2	21	−11	5	32
25	26	38	44	11	13	0	36	8	22	28
26	22	14	7	−25	− 6	− 6	15	−12	2	27
27	70	37	41	− 7	− 9	3	49	− 4	23	53
27	63	47	57	− 4	− 6	14	56	1	29	55
27	2	2	3	0	10	9	2	6	4	− 4
28	69	60	37	6	3	14	55	8	32	47
28	22	76	81	30	40	70	60	37	48	23
30	4	7	6	− 3	0	2	6	0	3	6
33	41	73	84	2	20	7	66	10	38	56
35	24	7	90	− 7	1	1	40	− 2	19	42
Av.....19.8	44.5	40.3	46.3	18.3	25.8	19.3	44.0	20.8	32.4	23.4
m.v..... 4.8	25.7	25.5	22.7	24.6	24.2	21.0	20.7	21.0	17.5	17.6
c.v..... 0.24	0.58	0.63	0.49	1.35	0.94	1.09	0.49	1.01	0.54	0.75
No. N.....	19	18	22	9	12	8	20	7	10	5

TABLE 4—Continued

Percentiles of Measurements—27 Boys. Mental Age 9

AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.	PHYS. AV.	PS. PH. AV.	TOTAL AV.	PHYS. EXCESS
9	89	87	70	99	92	94	82	95	89	−13
12	82	49	73	70	80	89	68	80	74	−12
15	85	82	97	50	53	55	95	53	74	42
15	85	81	74	9	37	39	80	28	54	53
15	5	7	3	5	2	7	5	5	5	0
16	59	20	10	4	9	18	30	11	21	19
17	95	90	100	64	83	90	95	79	87	16
18	48	74	58	37	91	6	60	45	52	15
18	83	40	82	47	81	50	68	59	64	9
18	35	12	57	−11	20	0	35	3	19	32
19	41	8	2	− 9	− 1	− 5	17	− 5	6	22
19	75	10	72	− 6	20	75	52	30	41	22
19	86	60	77	8	10	19	74	12	43	62
19	45	34	90	38	31	8	56	26	41	30
20	43	4	1	−24	−22	−10	16	−19	− 1	35
20	40	38	17	−52	−23	−16	32	−30	1	62
20	73	77	81	18	60	73	77	50	64	27
21	75	73	77	9	47	42	75	33	54	42
22	28	10	46	− 6	0	9	28	1	15	27
22	60	12	75	4	27	7	49	13	31	36
22	92	50	84	52	50	36	75	46	61	29
23	45	73	54	8	36	48	57	31	44	26
23	65	50	55	− 4	3	70	57	23	40	34
24	6	30	51	2	3	2	29	2	16	27
26	62	60	82	55	53	8	68	39	53	29
27	52	53	89	5	− 1	19	65	8	31	47
37	21	23	82	7	10	9	42	9	25	33
Av.....19.8	58.4	44.7	60.3	17.7	31.4	31.1	54.7	26.9	40.8	28.2
m.v..... 4.0	22.2	25.8	22.0	25.8	2.6	28.6	20.0	23.6	20.7	13.6
c.v..... 0.20	0.38	0.58	0.36	1.46	0.08	0.92	0.36	0.84	0.50	0.48
No. N.....	16	13	21	6	9	8	17	6	11	3

TABLE 4—Continued

Percentiles of Measurements—20 Boys. Mental Age 10

AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.	PHYS. AV.	PS. PH. AV.	TOTAL AV.	PHYS. EXCESS
13	59	66	92	88	91	7	72	63	67	9
14	71	52	44	0	15	53	56	23	39	33
15	74	68	45	45	60	35	62	47	55	15
15	7	9	10	9	10	8	9	9	9	0
15	86	79	87	86	90	93	84	90	87	− 6
16	93	95	90	90	91	75	93	85	89	8
17	22	15	17	25	26	20	18	24	21	− 6
17	17	10	25	4	9	19	17	11	14	6
17	60	41	38	9	18	6	46	11	29	35
17	20	16	8	7	1	8	15	5	10	10
19	26	10	1	2	32	0	12	11	12	1
20	40	37	54	−24	−12	− 3	44	−13	15	57
21	15	8	50	− 9	0	23	24	5	15	19
21	54	73	61	53	36	5	63	31	47	32
22	32	72	40	20	38	27	48	28	38	20
22	46	11	10	6	15	13	22	11	17	11
23	18	20	9	−35	−20	16	16	−13	1	29
23	83	73	76	20	25	64	77	36	57	41
27	95	93	75	11	75	9	88	32	60	56
29	33	30	82	10	45	33	48	29	39	19
Av.....19.3	47.5	44.0	45.7	20.8	31.8	25.5	45.7	26.2	36.0	19.5
m.v..... 3.6	24.8	28.1	25.0	26.2	26.8	19.6	23.4	20.4	21.2	14.8
c.v..... 0.19	0.52	0.64	0.55	1.21	0.84	0.77	0.51	0.78	0.58	0.76
No. N.....	9	9	9	4	5	4	8	3	6	3

Percentiles of Measurements—3 Boys. Mental Age 11

16	96	91	90	73	63	84	92	73	83	19
17	89	80	97	23	57	100	89	60	75	29
37	30	10	47	−10	− 8	10	29	− 3	13	32
Av.....23.3	71.7	60.3	78.0	28.7	37.3	65.0	70.0	43.3	57.7	26.7
m.v..... 9.1	27.8	33.6	20.7	29.6	30.2	36.3	27.3	31.0	29.1	5.1
c.v..... 0.39	0.39	0.56	0.27	1.03	0.81	0.56	0.39	0.72	0.51	19.1
No. N.....	2	2	2	1	2	2	2	2	2	0

TABLE 5

Percentiles of Measurements

Averages for 141 girls arranged by mental age

MENT. AGE	CASES	AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.	PHYS. AV.	PS. PH. AV.	TOTAL AV.	PHYS. EXCESS
1	9	14.9	14.7	11.8	19.6	−19.9	−23.5	−27.5	15.3	−23.5	− 4.2	38.8
2	29	16.4	20.4	16.6	34.8	−15.4	−12.1	−23.2	24.1	−17.0	3.7	40.9
3	15	14.7	33.7	28.0	30.9	− 0.1	8.3	−15.5	31.7	− 2.2	14.5	34.2
4	10	14.5	10.7	11.3	30.9	1.9	3.4	−14.4	17.5	− 3.1	7.2	20.6
5	15	16.7	25.0	21.5	46.3	11.1	19.0	− 3.4	30.9	8.9	20.1	22.0
6	13	19.7	41.7	41.5	59.5	20.0	22.8	1.6	47.3	15.0	31.6	32.2
7	23	20.3	47.1	40.0	54.0	30.0	39.0	20.6	47.0	29.7	38.6	17.4
8	9	21.4	34.5	35.5	63.1	14.0	19.1	2.8	44.7	11.9	28.7	32.7
9	12	23.6	43.1	43.4	50.6	31.3	34.9	26.9	45.8	31.2	38.6	14.5
10	5	28.0	39.2	50.4	76.6	31.6	40.0	19.0	55.4	30.0	42.8	25.4
11	1	17.0	72.0	64.0	70.0	30.0	65.0	55.0	69.0	50.0	60.0	19.0
Average[5]		18.8	34.8	33.1	48.8	12.2	19.6	3.8	39.0	11.9	25.6	27.1

TABLE 6

Percentiles of Measurements

Averages for 336 boys arranged by mental age

MENT. AGE	CASES	AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.	PHYS. AV.	PS. PH. AV.	TOTAL AV.	PHYS. EXCESS
1	18	16.0	21.6	15.4	24.4	−30.7	−25.4	−22.4	20.5	−26.2	− 2.9	46.7
2	48	17.0	30.6	22.9	37.9	−27.4	−18.2	−22.5	30.6	−22.8	3.9	53.3
3	32	16.9	29.1	27.8	34.0	− 7.1	1.4	−13.5	30.2	− 6.7	11.7	37.0
4	26	18.3	34.9	27.6	35.5	− 8.4	1.2	− 8.8	32.7	− 5.2	13.5	38.0
5	29	18.4	19.7	15.7	27.7	− 7.2	3.4	− 6.6	21.1	− 3.6	8.8	24.4
6	46	19.6	36.8	33.7	41.8	3.2	10.8	1.9	37.4	5.3	21.0	31.9
7	41	20.6	43.0	35.7	41.7	12.0	21.2	12.8	40.1	15.5	27.8	24.7
8	46	19.8	44.5	40.3	46.3	18.3	25.8	19.3	44.0	20.8	32.4	23.4
9	27	19.8	58.4	44.7	60.3	17.7	31.4	31.1	54.7	26.9	40.8	28.2
10	20	19.3	47.5	44.0	45.7	20.8	31.8	25.5	45.7	26.2	36.0	19.5
11	3	23.3	71.7	60.3	78.0	28.7	37.3	65.0	70.0	43.3	57.7	26.7
Average[5]		18.3	39.8	33.5	43.0	1.8	11.0	7.4	38.8	6.7	22.8	32.2

[5] The averages for tables 5 and 6 are not weighted, in order that the sexes might be more directly comparable. Because there are relatively more low-grade girls than low-grade boys and relatively fewer high-grade girls than high-grade boys, by chance selection, the weighted averages by mental age are spuriously affected in favor of the boys, on account of the dependence of the measurements upon mental age in general. The weighted averages for these two tables are the same as the averages given for Tables 9 and 10, respectively, which are weighted. Of course these total averages are only valuable for comparing the measurements and the sexes; otherwise they are meaningless.

TABLE 7

Percentiles of Measurements

Coefficients of variability for 140 girls arranged by mental age

MENT. AGE	CASES	AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.	PHYS. AV.	PS. PH. AV.	TOTAL AV.	PHYS. EXCESS
1	9	0.28	0.99	1.37	1.09	0.23	0.29	0.35	1.07	0.22	2.36	0.36
2	29	0.42	1.06	1.07	0.84	0.52	1.00	0.46	0.85	0.36	2.95	0.52
3	15	0.33	0.96	0.96	0.84	13.00	2.14	0.51	0.88	3.36	1.09	0.66
4	10	0.23	1.18	1.13	0.96	5.84	3.42	0.81	0.97	2.55	1.61	0.57
5	15	0.37	0.78	0.77	0.59	1.31	0.84	1.47	0.50	1.33	0.60	0.62
6	13	0.38	0.69	0.56	0.41	1.13	1.19	6.88	0.46	1.20	0.57	0.39
7	23	0.40	0.56	0.63	0.68	1.01	0.81	1.53	0.48	0.90	0.59	1.17
8	9	0.31	0.82	0.62	0.34	0.81	0.99	1.21	0.39	0.81	0.43	0.43
9	12	0.24	0.57	1.07	0.53	0.97	0.89	0.82	0.45	0.76	0.54	1.40
10	5	0.13	0.62	0.26	0.09	0.68	0.63	1.30	0.18	0.52	0.23	0.48
Average.....			0.82	0.84	0.64	2.55	1.22	1.53	0.62	1.20	1.10	

TABLE 8

Percentiles of Measurements

Coefficients of variability for 333 boys arranged by mental age

MENT. AGE	CASES	AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.	PHYS. AV.	PS. PH. AV.	TOTAL AV.	PHYS. EXCESS
1	18	0.39	0.96	0.86	0.83	0.66	0.53	0.18	0.84	0.41	3.89	0.43
2	48	0.34	0.72	1.80	0.67	0.76	0.96	0.36	0.66	0.56	3.46	0.35
3	32	0.33	0.95	0.88	0.87	1.89	9.43	0.62	0.82	1.55	1.39	0.49
4	36	0.31	0.90	0.97	0.67	1.85	16.50	0.63	0.77	2.38	1.29	0.50
5	29	0.30	0.95	0.96	0.96	2.51	5.53	1.29	0.83	3.81	1.64	0.51
6	46	0.39	0.76	0.59	0.69	5.72	1.72	6.95	0.65	3.00	0.86	0.60
7	41	0.34	0.56	0.69	0.56	1.54	1.00	1.54	0.54	1.16	0.64	0.63
8	46	0.24	0.58	0.63	0.49	1.35	0.94	1.09	0.49	1.01	0.54	0.75
9	27	0.20	0.38	0.58	0.36	1.46	0.08	0.92	0.36	0.84	0.50	0.48
10	20	0.19	0.52	0.64	0.55	1.21	0.84	0.77	0.51	0.78	0.58	0.76
Average.....			0.73	0.86	0.67	1.91	3.75	1.44	0.65	1.55	1.48	

TABLE 9

Percentiles of Measurements

Averages for girls by types of feeble-mindedness

TYPE	MENT. AGE	AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.	PHYS. AV.	PS. PH. AV.	TOTAL AV.	PHYS. EX-CESS
38 idiots.....	1.8	15.9	18.9	15.3	31.3	− 6.8	−14.8	−24.0	22.1	−18.4	1.8	40.5
76 imbeciles....	5.3	17.6	34.6	30.5	45.9	14.9	21.5	− 0.8	37.1	12.5	24.8	24.7
27 morons.....	8.9	23.7	40.8	43.0	60.5	25.7	31.9	18.6	47.9	25.2	36.8	22.6
141 Total.....	5.0	18.2	31.4	28.7	44.7	11.0	13.7	− 3.4	35.0	6.6	20.9	28.5

TABLE 10

Percentiles of Measurements

Averages for boys by types of feeble-mindedness

TYPE	MENT. AGE	AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.	PHYS. AV.	PS. PH. AV.	TOTAL AV.	PHYS. EX-CESS
66 idiots.....	1.7	16.8	28.2	20.9	34.3	−28.3	−20.0	−22.5	28.0	−23.8	2.1	51.6
174 imbeciles...	5.2	19.1	33.3	29.3	37.2	0.2	8.9	− 1.5	33.4	2.4	17.9	31.0
96 morons.....	8.8	19.8	49.9	42.9	51.1	18.9	29.0	25.4	48.0	24.3	36.6	24.0
336 Total.....	5.5	18.8	37.3	31.5	40.9	− 0.2	8.8	1.9	36.5	3.4	56.5	33.2

TABLE 11

Percentiles of Measurements

Number of girls reaching the normal average

MENT. AGE	CASES	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.	PHYS. AV.	PS. PH. AV.	TOTAL AV.	PHYS. EX-CESS
1	9	1	1	1	0	0	0	1	0	0	0
2	29	6	3	11	0	0	0	5	0	0	0
3	15	6	5	3	1	2	0	4	0	1	1
4	10	0	0	4	0	1	0	1	0	0	0
5	15	3	3	7	1	2	0	2	0	1	2
6	13	6	4	9	1	3	0	7	1	3	0
7	23	11	7	13	7	10	6	10	6	8	5
8	9	3	3	6	1	1	0	3	0	1	0
9	12	4	5	5	4	4	2	4	2	4	5
10	5	2	3	5	2	2	1	4	0	2	0
Total.....	140	42	34	64	17	25	9	41	9	19	13
Per cent.....		30	24	46	11	18	7	29	7	14	9

TABLE 12

Percentiles of Measurements

Number of boys reaching the normal average

MENT. AGE	CASES	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.	PHYS. AV.	PS. PH. AV.	TOTAL AV.	PHYS. EXCESS
1	18	4	1	3	0	0	0	1	0	0	0
2	48	12	7	16	0	0	0	10	0	0	0
3	32	9	8	10	1	2	0	8	0	2	0
4	26	10	7	5	1	2	0	8	0	2	0
5	29	3	2	9	1	3	0	3	1	0	2
6	46	16	9	18	4	4	3	17	3	8	2
7	41	14	11	18	3	7	5	14	3	7	5
8	46	19	18	22	9	12	8	20	7	10	5
9	27	16	13	21	6	9	8	17	6	11	3
10	20	9	9	9	4	5	4	8	3	6	3
Total.....	333	112	85	131	29	44	28	106	23	46	20
Per cent.....		34	26	39	9	13	8	32	7	14	6

TABLE 13

Pearson coefficients of correlation between percentiles and mental ages, corrected for irrelevancy of chronological age

SEX	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.	PHYS. AV.	PS. PH. AV.	TOTAL AV.	PHYS. EXCESS
Girls.....	.39	.47	.34	.69	.67	.63	.43	.66	.64	−.29
Boys.....	.31	.41	.23	.62	.81	.64	.31	.69	.53	−.39

TABLE 14

Pearson coefficients of correlation between percentiles and chronological ages, corrected for irrelevancy of mental age

SEX	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.	PHYS. AV.	PS. PH. AV.	TOTAL AV.	PHYS. EXCESS
Girls.....	−.30	−.32	.00	−.45	−.42	−.15	−.21	−.33	−.36	−.09
Boys.....	−.25	−.23	−.12	−.44	−.84	−.06	−.21	−.43	−.34	+.14

Table 15

Raw correlations between percentiles of measurements

GIRLS

TERM	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.
Stand. Ht.		.83	.64	.51	.57	.45
Sit. Ht.	.83		.64	.58	.56	.46
Weight	.64	.64		.45	.46	.36
R. Grip	.51	.58	.45		.87	.61
L. Grip	.57	.56	.46	.87		.61
Vit. Cap.	.45	.46	.36	.61	.61	

BOYS

Stand. Ht.		.78	.62	.54	.57	.41
Sit. Ht.	.78		.72	.58	.63	.49
Weight	.62	.72		.46	.50	.42
R. Grip	.54	.58	.46		.90	.63
L. Grip	.57	.63	.50	.90		.63
Vit. Cap.	.41	.49	.42	.63	.63	

Table 16

Correlations between percentiles of measurements, corrected for irrelevancies of age and mental age

GIRLS

TERM	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.
Stand. Ht.		.79	.62	.35	.43	.33
Sit. Ht.	.79		.62	.40	.37	.28
Weight	.62	.62		.35	.36	.15
R. Grip	.35	.40	.35		.75	.36
L. Grip	.43	.37	.36	.75		.36
Vit. Cap.	.33	.28	.15	.36	.36	

BOYS

Stand. Ht.		.75	.59	.43	.60	.31
St. Ht.	.75		.70	.43	.66	.35
Weight	.59	.70		.42	.69	.37
R. Grip	.43	.43	.42		.94	.49
L. Grip	.60	.66	.69	.94		.73
Vit. Cap.	.31	.35	.37	.49	.73	

TABLE 17

Rank order of corrected correlations between percentiles of measurements

GIRLS		BOYS	
Stand. Ht.—Sit. Ht.	.79	R. Grip—L. Grip	.94
R. Grip—L. Grip	.75	Stand. Ht.—Sit. Ht	.75
Stand. Ht.—Wt.	.62	L. Grip—Vit. Cap	.73
Sit. Ht.—Wt	.62	Sit. Ht.—Wt.	.70
Stand. Ht.—L. Grip	.43	Wt.—L. Grip	.69
Sit. Ht.—R. Grip	.40	Sit. Ht.—L. Grip	.66
Sit. Ht.—L. Grip	.37	Stand. Ht.—L. Grip	.60
Wt.—L. Grip	.36	Stand. Ht.—Wt.	.59
R. Grip—Vit. Cap	.36	R. Grip—Vit. Cap	.49
L. Grip—Vit. Cap	.36	Stand. Ht.—R. Grip	.43
Stand. Ht.—R. Grip	.35	Sit. Ht.—R. Grip	.43
Wt.—R. Grip	.35	Wt.—R. Grip	.42
Stand. Ht.—Vit. Cap	.33	Wt.—Vit. Cap	.37
Sit. Ht.—Vit. Cap	.28	Sit. Ht.—Vit. Cap	.35
Wt.—Vit. Cap	.15	Stand Ht.—Vit. Cap	.31

RESULTS

In considering the results it must constantly be recalled that unless specified to the contrary the discussion deals always with percentiles of comparison derived from the Smedley age and sex tables. The attempt has been made to eliminate chronological age and sex by comparing the original measurements with the Smedley tables, in order to treat the results solely on the basis of their relation to each other and to mental level. Wherever sex and age conditions are discussed, they are always *in addition* to the differences already eliminated in the comparisons, unless stated to the contrary. This necessitates discussion in terms of relations to normal rather than in absolute terms. The discussion is further specifically limited to the data in hand and general terms apply only to the groups of subjects herein investigated.

In the discussion, conclusions are occasionally derived from data not summated in the tabular form. These conclusions may be verified from the original material if so desired. It has not been possible to put all the material into tables; much of value can be gleaned only from the actual handling of the material. These conclusions we have not hesitated to state, feeling sure of the material and of the verification of such statements in the data.

In comparing these results with the Smedley norms, it is assumed from the type of distribution presented in the percentile tables that the 50

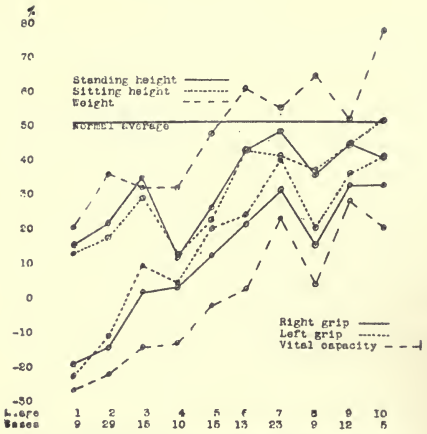


Fig.1-Curves for girls, showing average percentiles for all measurements in relation to mental ages.

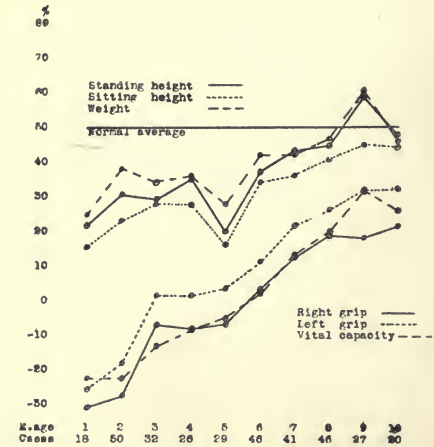


Fig.2- Curves for boys, showing average percentiles for all measurements in relation to mental ages.

percentile is the average (more accurately, the median) for each measurement. This may not be entirely correct for each table but seems a valid assumption. This is not so justifiable, though reasonably correct, for the physical and psycho-physical averages, since it is conceivable that the averages by individuals might be different from the averages of the medians. Unfortunately, it is not possible to compute variability from these tables except by approximate quartiles, and we cannot therefore discuss com-

parative variability for the present results. There is every reason to believe, however, that the feeble-minded are much more variable throughout than the normals. This has already been demonstrated by previous studies in this field.

Standing Height

Dependence upon mental level. The feeble-minded of all grades are below normal in standing height. There is a marked dependence of the degree of subnormality upon degree of feeble-mindedness. By exact mental ages there is a positive correlation of more than .30 (P. E. negligible) between mental age and height. By types of feeble-mindedness this relation is more marked. The higher mental types, the morons, approximate the normal. These conclusions are in accord with the findings of

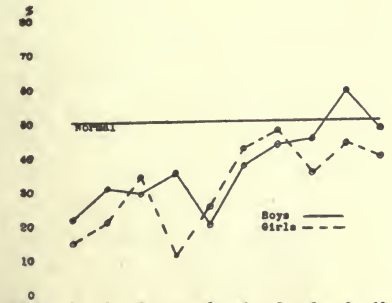


Fig.3- SEX CURVES-----STANDING HEIGHT

Goddard, Mead, and others with respect to the feeble-minded. They are also in agreement with the conclusions of Gratsianoff, Sack, Porter, MacDonald, Smedley, and DeBusk, with normal subjects, that bright children tend to be taller than dull.

Dependence upon chronological age. In absolute units the increase in height in relation to age continues up to the age of about 16. The feeble-minded not only grow at a retarded rate but also cease growing at an earlier age. By comparison with the Smedley measurements for normals there is a correlation of nearly $-.20$ between percentiles of height and chronological age. This confirms Goddard's similar conclusion, but negatives for the feeble-minded at least, the theory affirmed by some writers that children who grow at a retarded rate continue their growth to a later age.

Variability. In general, there is considerable variability in height in relation to mental capacity, the coefficient of variability is only once less

than .50 and decreases with increase of age, showing the lower grades of feeble-minded more variable than the higher. The average coefficient of variability for all feeble-minded is approximately .75.

Sex differences. Sex differences are noticeable, but not very significant. The mental age curve for boys is superior at six ages and inferior at four ages to that for girls. The correlation with mental age is 26 per cent higher for girls. The total average height is 14 per cent nearer the normal for boys. Boys grow to a slightly later age than girls and at a slightly less retarded rate. Girls are more variable than boys. These conclusions are the more apparent since sex differences were allowed for and should have disappeared in obtaining percentiles of comparison. So far as the sex differences are apparent they are opposite to those found by Mead.

Relation to other measurements. Standing height is less subnormal than sitting height and more subnormal than weight. It is at all points closer to normal than strength of grip or vital capacity. It is most highly correlated with sitting height and least with vital capacity.

Diagnostic value. With so marked a dependence not only upon mental defect but also upon degree of defect, it might be expected that comparative height might be of some value as a symptom of mental retardation. Such is actually the case, but only to a limited extent. Of all these feeble-minded, only 30 per cent attain the normal average. Moreover, the correlation of more than .30 between the percentiles and mental age shows a positive tendency for these percentiles to be somewhat symptomatic of degree of defect also. On the other hand, variability is high and the individual diagnosis is limited by heredity, nationality, race, disease, environment and the like. Nevertheless, although comparative standing height alone cannot be seriously considered in diagnosing mental defect, it is confirming evidence when found in combination with other symptoms in determining defect, since only one third of all feeble-minded approximate to normal measurements. The better diagnostic use, however, is in connection with other anthropometric measurements rather than by this measurement alone.

Sitting Height

Dependence upon mental level. The feeble-minded of all grades are below normal in sitting height. The degree of subnormality is closely correlated with degree of feeble-mindedness; the Pearson correlation between percentiles of sitting height and mental age is more than 0.40. By types of feeble-mindedness the dependence upon degree of mental defect is even more marked than by mental age. The highest types, the morons,

approximate the normal average. There are but few comparisons for this measurement on defectives in the literature.

Dependence upon chronological age. The same influence of age obtains here as in the case of standing height. There is a correlation of about −.30 between comparative percentiles and age. The feeble-minded develop at a retarded rate and cease growing earlier than normals.

Variability. In relation to mental age, sitting height is quite variable. The coefficient of variability seldom falls below .60 for any mental age, with an average of .85 for all ages. There is decrease of variability with increase of mental age.

Sex differences. Sex differences in average sitting height are negligible. The percentiles for girls show slightly more correlation with mental age and slightly more dependence upon chronological age than do those for boys. Average variability is almost exactly the same for both sexes, being very slightly less for girls.

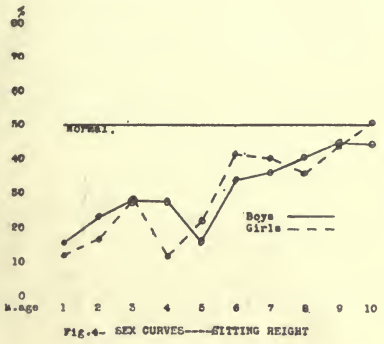


Fig.4- SEX CURVES----SITTING HEIGHT

Relation to other measurements. Sitting height is consistently more subnormal than standing height. Otherwise it bears the same relation as standing height to the other measurements, being more subnormal than weight and less so than strength of grip or vital capacity. Sitting height is most highly correlated with standing height and least with vital capacity. Sitting height also shows slightly higher correlation with weight than does standing height. In general, the correlations between sitting height and other measurements are about the same as those between standing height and these measurements.

Diagnostic value. Seventy-five per cent of all feeble-minded fail to reach the normal average in sitting height. This gives a fairly high diagnostic value. The degree of subnormality is also somewhat diagnostic of the degree of defect. That sitting height is more subnormal than standing

height is important when the two measurements are used together, or in connection with the other measurements. For individual diagnosis the same objections and advantages hold good as for standing height.

Weight

Dependence upon mental level. The averages in weight for boys are below normal at all mental ages but 9; those for girls are above normal after mental age 5. The relation of weight to mental age finds expression in a correlation of about .30. The dependence upon grade of feeble-mindedness is better shown in the averages by types. The higher types, the morons, exceed the normal average, slightly for boys, but markedly for girls. These results agree with those of Goddard and of Mead. Investigations by Porter, Smedley, and DeBusk with normal children also show dependence of weight upon mental ability.

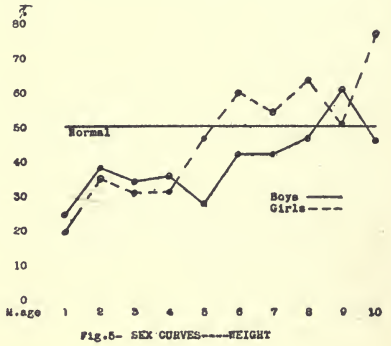


Fig.5- SEX CURVES----WEIGHT

Dependence upon chronological age. Both girls and boys continue to increase in weight to a later age than is the case with height. The rate of growth in weight is not so markedly subnormal. The comparative percentiles are not at all affected by age for boys and only slightly for girls.

Variability. The coefficient of variability is seldom below .50 with a total average of about .65. The decrease of variability with increase of mental age is marked with girls, and is apparent, though not so consistently, with boys.

Sex differences. Boys are slightly superior to girls at five mental ages and markedly inferior at five. They are slightly more variable. The correlation with mental age is greater with girls than with boys. Girls increase in weight at a less retarded rate and to a later age than do boys. After mental age 5, girls are above the normal average, but boys are always

below except at mental age 9. Moron girls are above normal in weight and moron boys reach the normal. These sex differences agree with those found by Mead.

Relation to other measurements. Weight is closer to normal than either standing or sitting height. It is also superior in this respect to strength of grip or vital capacity. For boys, weight is most highly correlated with sitting height and for girls is correlated equally with standing and sitting height. The correlation with height is approximately the same as that found by Schuster for Oxford students (.66) and higher than that for Cambridge students (.49).

Diagnostic value. Taken alone, weight has but little value for diagnosis of feeble-mindedness in the highest mental ages, but has some value in the lower ages. Approximately 40 per cent of all feeble-minded reach the normal average, but the per cent applies chiefly to the higher types of defect. In relation to the other measurements, weight is of importance for diagnosis. In the typical case it is highest of all the six measurements and is close to normal. This superiority of relative weight over relative height may be considered of some diagnostic assistance in connection with other symptoms.

Right Grip

Dependence upon mental level. Barr has aptly said that strength of mind and strength of hand accompany each other. Our results tend strongly to confirm the statement. Strength of grip is so markedly subnormal that frequently the measurements fall outside the norms of comparison. For such measurements we have applied the somewhat artificial rule described on page 11. A close relationship is demonstrated between right grip and mental age; the coefficient of correlation is nearly .70. At no mental age do the averages approximate the normal, and only 10 per cent of all individual cases do so. By types of feeble-mindedness the dependence of degree of subnormality upon degree of feeble-mindedness is even more marked; even the highest types fail to reach an approximation to normal. This general relation to mental ability is abundantly confirmed by other investigators by other methods of study, with both normal and feeble-minded subjects.

Dependence upon chronological age. The comparative percentiles do not eliminate all the influence of age upon strength of grip; after allowing for influence of age through the Smedley tables there is still a correlation of −.45. Increase of age, therefore, tends to emphasize instead of to elimi-

nate the effect of the mental defect, for with increase of age there is greater subnormality of grip.

Variability. In relation to mental age, right grip is extremely variable. The coefficient of variability is seldom below 1.00, with an average coefficient of more than 2.00. Apparently there is increase and then decrease of variability with increase of mental age. This is to be accounted for by the high percentage of absolute failures in the earlier ages which tends to eliminate variability in those ages.

Sex differences. Girls are markedly closer to normal than boys in strength of grip, and show a somewhat higher correlation with mental age. The influence of age is the same for both sexes. Girls are also much more variable than boys.

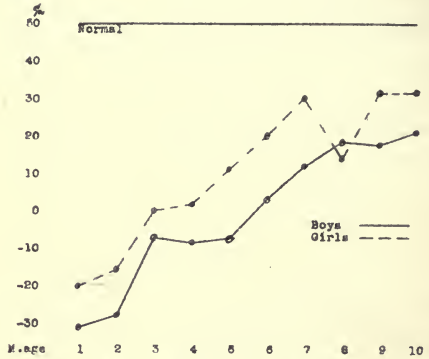


Fig.7- SEX CURVES----RIGHT GRIP

Relation to other measurements. Right grip is more subnormal than standing height, sitting height, or weight. It seldom approximates the normal and usually is very markedly below normal. Its highest correlation is with left grip, its second with height, its third with weight and its least with vital capacity. The greater dependence upon height than weight is somewhat surprising, in view of the usual statements of relation of grip to weight.

Diagnostic value. Strength of grip has a high diagnostic value. Ninety per cent of all feeble-minded fail to reach the normal average. Strength of grip is associated with degree of defect as well as of defect itself, with a correlation of nearly .70 between percentiles and mental ages. On the other hand, variability is very high and this tends to lessen the diagnostic value. But the value for diagnosis is much increased when this measurement is considered in connection with other physical and psycho-physical measurements. The relation, for instance, of the percentile of grip to the

percentiles of height and weight bears a highly diagnostic value, particularly in combination with other symptoms. Taken alone, grip must be considered in relation to physique as well as to mental capacity.

Left Grip

Dependence upon mental age. Left grip bears the same relation to mental age as does right grip, save that it is somewhat more highly correlated with it.

Dependence upon chronological age. Left grip is markedly affected by age. After eliminating age through the comparison percentiles there still exists a high negative correlation with age in general, and this is very high for boys. In general, the effect of age is the same as upon right grip, but is more marked.

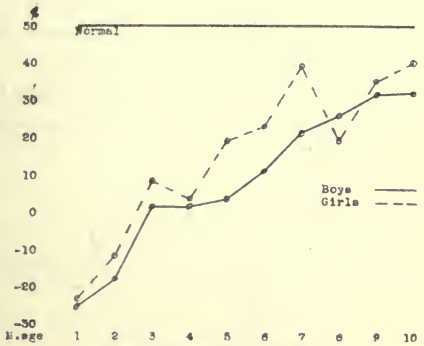


Fig.8-SEX CURVES----LEFT GRIP

Variability. Left grip is highly variable, particularly in the middle mental ages, imbecility. The dependence of variability upon mental age is approximately the same as for right grip.

Sex differences. Girls are closer to normal than boys at all mental ages but one. They also are less variable than boys, show less correlation with mental age, and less dependence upon chronological age; these differences are opposite to the relations for the sexes in right grip.

Relation to other measurements. Left grip is closer to normal than right grip, but not so close as height or weight. Its highest correlation is with right grip. The other relations are quite different for the sexes; for girls there is more dependence of left grip upon height than weight, whereas the reverse is true for boys. For boys the correlation of left grip with vital capacity is much higher than is the case with girls. These relationships are much affected among boys by the serious correction of the coefficient of

correlation for the irrelevancy of chronological age. In the raw coefficients left grip bears about the same relation to other measurements as does right grip.

Dextrality. The feeble-minded of all grades are predominantly left-handed in strength of grip, as is shown by the superiority of the averages for left grip over right and the high correlation existing between them. These results do not show a tendency toward ambidexterity but toward sinistrality at all ages and grades. This tendency is even more apparent in a detailed examination of the data. (Cf. 26, p. 107.)

Diagnostic value. Strength of left grip has a highly diagnostic value in relation to normal standards. It is highly correlated with degree of defect as well as with mental defect itself. Only about 15 per cent of feeble-minded cases reach the normal average. Variability, however, is quite high, although the correlation with mental age is also high. In relation to other measurements the diagnostic value is increased; left grip is closer to normal than right grip but not so close as height or weight. The percentile must be considered in relation to height and weight as well as to mental capacity. Sinistrality is in suspected cases a symptom.

Vital Capacity

Dependence upon mental age. As in strength of grip, so also in vital capacity all feeble-minded are markedly below normal. The degree of

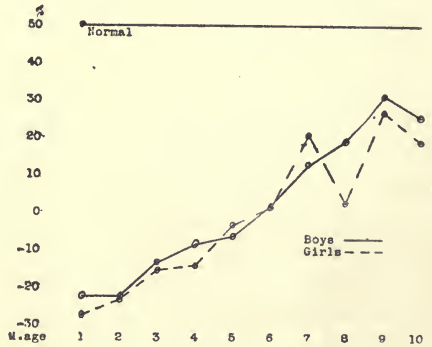


Fig.9-SEX CURVES----VITAL CAPACITY

subnormality bears a close relation to exact mental ages (r = .64), and a more distinct relation to types of feeble-mindedness. This conclusion is abundantly corroborated by Goddard's experience. The dependence upon mental capacity among normals is also shown by Smedley and by De Busk, although negatived by Gilbert.

Dependence upon chronological age. There is a little dependence of performance upon chronological age in addition to that which is found among normals.

Variability. In relation to mental age, vital capacity is highly variable. The coefficient of variability is seldom below 1.00, with an average of about 1.50. The relation of variability to increase of mental age is the same as for strength of grip, showing both increase and decrease. The increase in variability during the lower mental ages, idiocy, is again accounted for by the higher percentage of absolute failure among those subjects, which tends to reduce variability.

Sex differences. There are practically no sex differences aside from those existing among normal subjects.

Relation to other measurements. Among boys, the percentile of vital capacity agrees very closely with that of right grip, but with girls it is the lowest of all measurements. Its correlations with mental age are the same as for the grips and much higher than those for height and weight. Vital capacity shows the least dependence of any upon the other measurements. The highest correlations are with strength of grip and the least with height and weight. The high correlations between height and vital capacity found by some investigators, and between vital capacity and weight by others, are not strongly corroborated by these data. Distinct positive correlations are apparent, but are not nearly so high as those previously reported (notably Schuster who found a correlation of .57 with height and .59 with weight).

Diagnostic value. Vital capacity is highly diagnostic of mental defect and also of degree of defect. The subjective reactions of some subjects have already been noted (page 10). But considering that it shows the greatest subnormality of all these measurements, that it shows the least dependence upon height and weight, and a high correlation with mental age, and that only 8 per cent of all feeble-minded reach the normal average it could safely be taken alone as a highly reliable single index of mental incapacity.

Physical Average

It is possible that the average of the three physical measurements might prove of greater value for diagnosis than any of the physical measurements taken singly. It is possible, too, that such an average might have less variability and a greater dependence on mental ability than each of the measurements alone. It is also desirable to have a single value for expression of the physical measurements in relation to the psycho-physical, as will appear later.

Dependence upon mental level. In general the physical average, as might be expected, parallels the average for height and weight. This average, however, is more regular than any of the three single measurements. The correlation between the average and mental age also represents what would be obtained by pooling the three individual correlations. In general, the average for morons of both sexes approximates the normal. By types of feeble-mindedness the dependence upon degree of mental defect is more marked than by mental ages.

Dependence upon chronological age. The correlation between the physical average and chronological age is $-.21$, approximately an average of the individual items.

Variability. The physical average shows noticeably lower variability than any of the single measurements. Variability is high, however, with an average coefficient of variability of about .60. The decrease in variability with increase of age is marked.

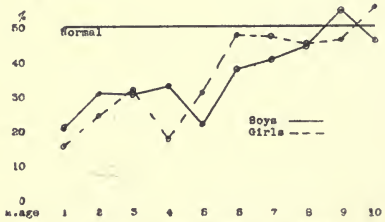


Fig.6- SEX CURVES----PHYSICAL AVERAGE

Sex differences. Sex differences are about equal; at four ages girls are closer to normal than boys and at four others boys are closer than girls, by about equal amounts of superiority. The average for girls approximates the normal after mental age 5 because of superiority in weight. Girls are slightly less variable than boys in the total average variability.

Relation to other measurements. The physical average approximates the mean of the three physical measurements. Its most important relation to other measurements is found in the relation it bears to the psychophysical average, as will be shown later.

Diagnostic value. Seventy per cent of all feeble-minded fail to reach the normal physical average. This is a fairly high diagnostic percentage. Nevertheless, individual differences in relation to mental age are serious, and many conditioning factors of race, environment, health, *et altera* must be considered. The diagnostic value is greater for idiots and imbeciles than for morons. Its value is also greater in connection with the psychophysical average.

Psycho-Physical Average

As the physical average presents some advantages over the individual physical percentiles, so the psycho-physical average is, for some purposes, of greater value than the individual psycho-physical percentiles. This average is also of great importance in relation to the physical average.

Dependence upon mental age. In general, this average represents the mean of its three elements. The dependence on mental age, however, is more marked and more regular than for any of the individual measurements; the correlation with mental age is somewhat higher than that of the pooled correlation of the individual terms. By types of feeble-mindedness the dependence upon degree of defect is very pronounced. At no point is the normal average approximated.

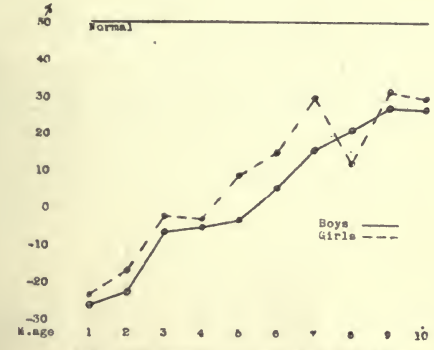


Fig.10- SEX CURVES----PSYCHO-PHYSICAL AVERAGE

Dependence upon chronological age. The influence of chronological age is expressed in the correlation of approximately $-.40$.

Variability. Average variability is less for the psycho-physical average than for any of the individual psycho-physical percentiles, but is very high; the average coefficient of variability is, roughly, 1.50. The increase and succeeding decrease of variability in relation to mental age is about the same as for the single terms.

Sex differences. Girls of all mental ages but one are closer to normal than boys. They are also less variable than boys. Boys show a higher correlation with mental age and a greater influence of chronological age.

Relation to other measurements. For boys the psycho-physical average is close to the averages for right grip and vital capacity, for girls to right grip and left grip. The average is at all points much more below normal than the physical average. The especial significance of this relationship

is discussed under the section PHYSICAL EXCESS. This relationship also determines the slope of the curve and its diagnostic value.

Diagnostic value. Taken alone, the psycho-physical average has a highly diagnostic value, higher than any of its individual components. Only 7 per cent reach the normal average, and the correlation with mental age is quite high. The diagnostic value is even higher for mental defect of all grades and very high for diagnosis of feeble-mindedness by types. Variability, however, is high and some allowance must be made for physical capacity and for chronological age. In connection with the physical average, the diagnostic value is much increased and is expressed in the ratio of the physical to the psycho-physical average both absolutely and fractionally, which is graphically expressed in the slope of the curve.

TOTAL AVERAGE

It is conceivable that the total average of all the six measurements might present valuable conclusions not apparent in any of the individual

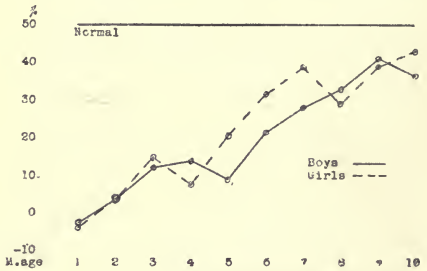


Fig.11- SEX CURVES----TOTAL AVERAGE

measurements. This average has been computed also for use in considering all the measurements for a single pooled comparison with mental age and with normality. That this average is actually of considerable value for some purposes is apparent from the tables.

Dependence upon mental level. Rather surprisingly, the total average shows a greater dependence upon mental age than any of the physical measurements or the physical average, and equal to the psycho-physical measurements and their average; the correlation with mental age is approximately .60. The curve showing increase in average in relation to increase in age is quite steep and regular. At no point does the average reach the normal average. By types of feeble-mindedness the relation of degree of subnormality to degree of mental defect is distinctly evident.

Dependence upon chronological age. The total average percentile is affected by age; with increase of age there is decrease in average, which is expressed in the correlation −.35.

Variability. The average coefficient of variability for all ages is about the same as for the psycho-physical average, but the dependence of decrease in variability upon increase of mental age is the most pronounced of all the terms, decreasing from a coefficient of nearly 4.00 for idiocy to approximately .50 for moronity.

Sex differences. For mental ages 5, 6, and 7, girls are closer to normal than boys, being about equal at other ages. The correlation with mental age is considerably higher with girls and variability is lower; the influence of age is the same for both sexes.

Relation to other measurements. The total average percentile is approximately the mean of the six individual percentiles, but in its variability and correlations more closely resembles the psycho-physical than the physical terms.

Diagnostic value. The total average is highly diagnostic of mental defect only 14 per cent of individual cases reach the normal average. The correlation with mental age is also fairly high and the relation to type of feeble-mindedness is pronounced. But variability is high, particularly in the lower mental ages.

Physical Excess

It has been anticipated that the greatest significance of the measurements lies in the relation of the physical average to the psycho-physical

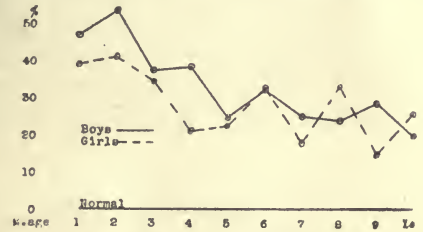


Fig.12- SEX CURVES----PHYSICAL EXCESS

average. The tables and curves demonstrate the consistent superiority of the physical measurements over the psycho-physical. Ninety-three per cent of all individual cases show this physical superiority. This relationship may be expressed in absolute terms of the former to the latter, or in the fractional ratio, or in the excess of physical average over psycho-physical.

It may then be questioned whether either the *amount* of this superiority or the integral value of the ratio is affected by any of the conditions previously considered. The algebraic difference between the two averages has therefore been computed to investigate this possibility.

Dependence upon mental level. Only 7 per cent of all feeble-minded fail to show a superiority of physical over psycho-physical average. The extent of the superiority bears an inverse relation to mental age, with a correlation of approximately −.35. The relationship is more pronounced for types of feeble-mindedness than for exact mental ages. (The normal average is in this case 0, instead of 50 as for all other terms.)

Dependence upon chronological age. There is practically no influence of age upon physical excess.

Variability. Variability is quite high; the average coefficient of variability ranges near .50. There is no decided relationship between variability and mental age.

Sex differences. The dependence of excess upon mental age is more marked with boys than with girls, although for the total group regardless of mental age there is but little sex difference. Correlation with age is higher with boys and variability is higher with girls. Influence of chronological age is slight but opposite in effect.

Diagnostic value. Physical excess itself is highly diagnostic of feeble-mindedness, but the degree of excess is not very highly correlated with mental age. The absolute ratio, as well as the reduced ratio, of physical to psycho-physical average must be considered in a diagnosis. Excess of physical average may ordinarily be considered diagnostic of feeble-mindedness (so far as a single group of tests ever is diagnostic), and the absolute ratio of physical to psycho-physical average, that is to say, the position of the curve up or down on the graph sheet as well as the slope of the curve, is valuable in the diagnosis of type of feeble-mindedness as well as of feeble-mindedness itself. This absolute ratio cannot be used for determining exact mental ages.

Summary of Diagnostic Values

I. In the typical feeble-minded subject there is significance in the relation of the individual measurements to each other and to the normal.

a. Standing height is below normal and the degree of subnormality is correlated with degree of mental defect.

b. Sitting height is more subnormal than standing height, but closely associated with it.

c. Weight is closer to normal than either standing or sitting height and approximates the normal average, often exceeding it among girls. Weight is associated with height.

d. Right grip is more subnormal than either height or weight and degree of subnormality is closely associated with mental age.

e. Left grip is closer to normal than right grip but is more subnormal than height or weight. It is closely associated with right grip. The typical feeble-minded person is relatively stronger in left grip than in right. (Sinistrality in grip does not necessarily imply sinistrality in other manual activities.) Both right and left grip are associated with height and weight.

f. Vital capacity shows the most marked subnormality of all the measurements, particularly among girls. It also shows a high correlation with mental age and the least dependence upon the other measurements.

II. The physical average is more reliable for diagnosis than each of its three elements,except for the relation of the three to each other and to the normal.

III. The psycho-physical average is closely correlated with mental age as well as with mental defect itself and is highly diagnostic taken alone. Some allowance must be made for physical measurements and for chronological age.

IV. The total average is closely correlated with mental age as well as with mental defect.

V. The excess of physical average over psycho-physical is characteristic of all feeble-minded. The amount of excess is not so reliable in a diagnosis of degree of mental defect as is the absolute ratio of the two averages. There is 75 per cent probability that in connection with physical excess a psycho-physical average between +10 and +50 indicates moronity, between +10 and −15 indicates imbecility, and under −15 indicates idiocy.

VI. In all of the averages variability is high, and reduces the diagnostic value of the individual measurements when considered alone. The central tendencies at the several mental ages are not sufficiently exclusive of each other to permit of satisfactory classificatory value. This is true even of the total average. The method of limits might be applied and found to serve for this purpose, though the author does not advocate it.

VII. In individual diagnosis considerations of race, nationality, heredity, environment, physiological development, health, exercise, physical defects, and special personal history must never be omitted. The limitations of the comparison tables must also be recognized.

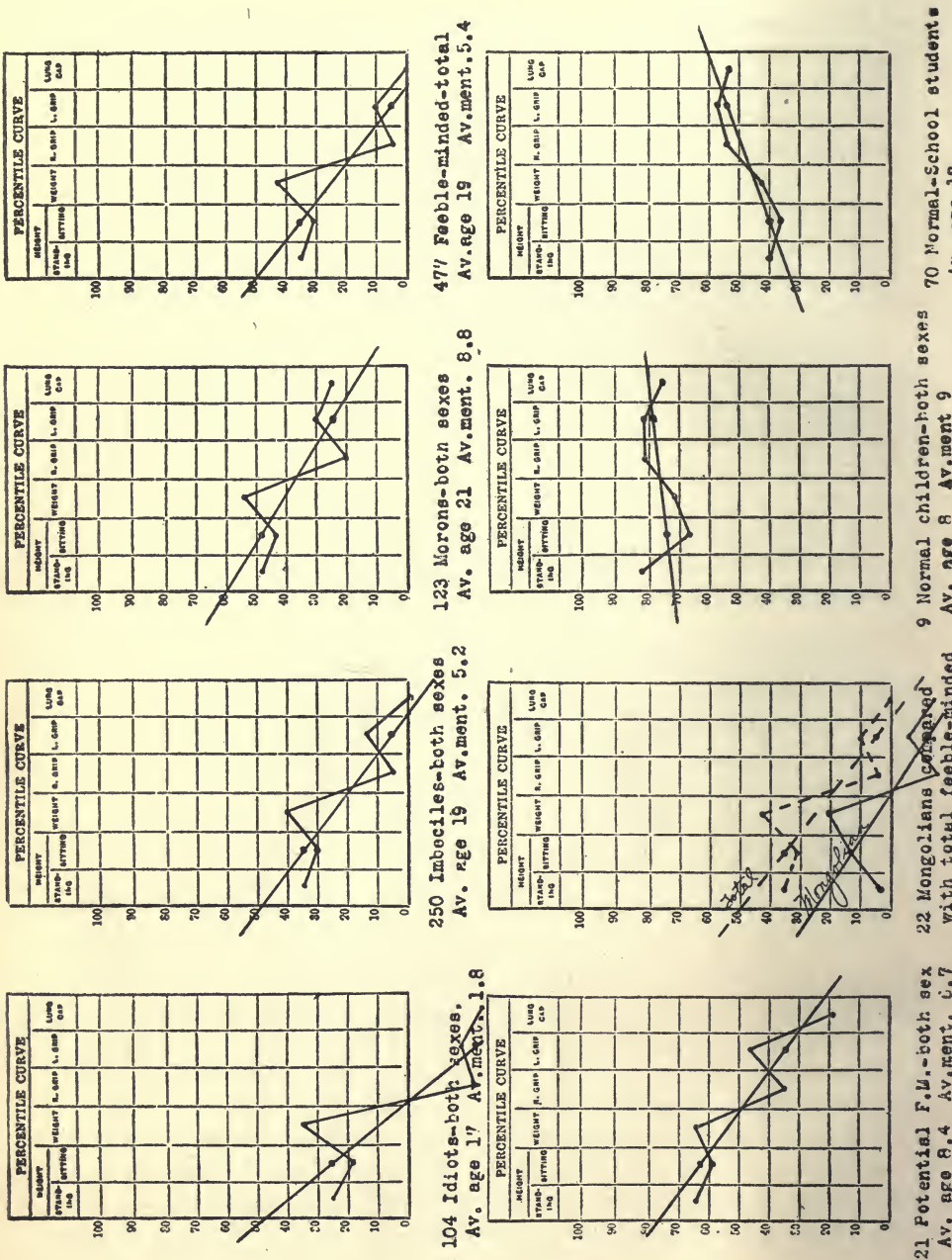


PLATE I. AVERAGE TYPE CURVES.

VIII. There is reason to believe that the measurements are also of value in detecting pathological or clinical varieties of feeble-mindedness, such as insanity, epilepsy and Mongolianism. Table 18 was constructed from data on 22 Mongolians included in the general tables. The typical curve from these averages, compared with the total feeble-minded curve shows the

TABLE 18

Percentiles of Measurements—22 Mongolian Feeble-minded.

8 Girls

MENT. AGE	AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.	PHYS. AV.	PS. PH. AV.	TOTAL AV.	PHYS. EXCESS
2	7	5	0	11	−16	−11	−50	5	−26	−11	31
2	13	−15	− 6	− 5	−14	−15	−39	− 9	−23	−16	14
3	9	− 3	3	21	−10	8	−12	7	− 5	1	12
3	10	14	27	20	− 3	3	− 8	20	− 3	9	23
3	14	6	8	9	−10	− 8	−17	7	−12	− 2	19
4	16	− 1	7	3	− 4	0	−12	3	− 5	− 1	8
5	14	8	17	40	− 6	15	− 4	22	2	12	20
6	31	7	44	108	3	− 5	− 4	53	− 2	26	55
					14 Boys						
1	10	7	9	21	−33	−20	−20	12	−24	− 6	36
2	5	44	68	67	−15	17	−24	66	− 7	30	73
3	11	10	12	9	1	8	− 5	10	1	5	9
3	18	−16	− 3	0	−23	− 7	−20	− 6	−17	−12	11
3	25	− 2	5	− 9	−11	− 3	−37	− 2	−17	−10	15
4	14	1	− 4	5	− 5	− 1	− 1	1	− 2	− 1	3
4	18	−26	3	43	−28	−17	−16	7	−20	− 7	27
4	20	4	4	5	− 4	−13	−10	4	− 9	− 3	13
4	20	4	7	7	−25	0	− 8	6	−11	− 3	17
4	23	9	8	5	−21	−18	−17	7	−19	− 6	26
4	34	6	15	21	−38	−22	− 9	14	−23	−10	37
5	18	−49	−14	− 7	−35	−43	−34	−23	−37	−30	14
5	19	24	35	− 6	−28	−10	0	18	−13	3	31
5	23	20	35	83	0	7	42	46	16	31	30
Av. 3.6	17.3	2.6	12.7	20.5	−14.8	− 6.1	−13.9	12.2	−11.6	− 0.1	23.8

Mongolians to have the general but not the specific feeble-minded characteristics. It is important to note that Mongolians are characteristically short and heavy, and also long-waisted. Both physically and psycho-physically they are below the total feeble-minded average (the curves are comparable for mental ages), and except in height and weight show the other feeble-

minded characteristics. The specific characteristics of epileptic and insane types in the measurements are not yet entirely clear. In general, such clinical types show the general characteristics of the feeble-minded reactions but not their specific nature. Thus, for instance, a typical insane case has the excess of physical over psycho-physical average, and also the psycho-physical subnormality, but the dependence of the measurements upon mental level is not consistent, as is the case in "pure" feeble-mindedness and the specific relationship of the individual measurements to each other is not such as obtains with typical normals nor with typical feeble-minded. A study was made of the insane feeble-minded cases and showed that such cases deviated markedly in either direction from the typical feeble-minded averages. But these deviations neutralize each other in averaging the measurements for the group, and the resulting central tendency is the same as the typical group.

IX. Allowance must be made for the absolute values of the two averages; there is good reason for believing that if the psycho-physical average is above normal (the 50-percentile), excess is not so significant as when this average is below normal. This physical excess in conjunction with a psycho-physical average above 50 is rarely found with feeble-minded subjects, but occurs among normal children and especially among adults. Experience indicates that the method is not applicable to normal subjects above say 21 years, and with feeble-minded subjects decreases in reliability with increase of age beyond this point.

Reliability of Diagnostic Values

So far as any one test or group of tests is reliable for diagnosis, this group of six tests when treated as described above has an unusually high diagnostic value. This value is increased for practical purposes by the simplicity of the tests and the ease and rapidity with which they can be used. Three minutes ordinarily suffice for taking the measurements, and perhaps two more for deriving the percentiles and curve. This should make the tests particularly desirable in necessarily hurried examinations of large groups of subjects or in preliminary examinations for purposes of classification. The tests are of especial value when a differential diagnosis is to be made from the results of examinations in several groups of tests.

But since this study deals primarily with only feeble-minded subjects it may be questioned how reliable the findings are among other groups of subjects as controls. Unfortunately, large numbers of measurements of individual normal children were not available, but such as were have been

TABLE 19

Percentiles of Measurements—21 Potential Feeble-Minded

6 Girls

MENT. AGE	AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.	PHYS. AV.	PS. PH. AV.	TOTAL AV.	PHYS. EXCESS
5.2	6.5	30	43	46	80	85	− 3	40	54	47	−14
6.6	7.3	75	84	60	55	90	−13	73	44	59	29
6.6	8.2	50	45	30	7	7	− 5	42	3	23	39
6.4	9.0	60	63	63	10	20	7	62	12	37	50
7.0	9.5	85	83	65	10	10	8	78	9	44	69
9.0	10.8	94	85	91	90	92	86	90	89	90	1
Av. 6.8	8.6	65.7	67.2	59.2	42.0	50.7	13.3	64.2	35.2	50.0	29.0
% N		83	67	67	50	50	16	67	33	33	33

15 Boys

2.8	5.5	82	88	104	17	7	−40	91	− 5	43	96
4.8	6.4	24	17	45	5	10	3	29	6	18	23
5.0	6.4	26	15	37	3	15	−15	26	3	15	23
6.6	7.3	92	91	75	20	91	7	86	39	63	47
5.0	7.7	30	18	55	5	6	− 3	34	3	19	31
5.8	7.8	72	30	57	10	40	28	53	26	40	27
7.8	7.8	97	94	94	90	90	100	95	93	94	2
7.2	8.6	92	94	90	25	30	12	92	22	57	70
6.6	9.0	16	14	26	− 3	6	− 6	19	− 1	9	20
6.8	9.0	92	92	91	70	95	36	92	67	80	25
7.6	9.5	83	64	90	60	77	54	79	67	73	12
9.6	9.6	90	88	72	99	92	94	83	95	89	−12
8.0	9.8	53	53	30	17	20	10	45	16	31	29
7.8	10.1	25	18	40	30	27	30	28	29	29	− 1
7.4	10.3	73	68	60	55	70	0	67	42	55	25
Av. 6.6	8.3	63.2	56.3	64.4	33.6	45.0	20.7	61.3	33.5	47.7	27.8
% N	....	67	60	67	33	40	20	60	27	47	33

TABLE 20

Percentiles of Measurements—9 Normal Children. 3 Girls, 6 Boys

MENT. AGE	AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.	PHYS. AV.	PS. PH. AV.	TOTAL AV.	PHYS. EXCESS
9	6	91	74	80	80	75	83	82	79	81	3
10	9	85	82	83	70	70	80	83	73	78	10
12	11	94	83	90	91	70	95	89	85	87	4
5	4	50	40	46	75	90	20	45	62	53	−17
7	5	75	56	60	63	90	45	64	66	65	− 1
8	6	93	72	53	83	91	92	73	89	81	−16
11	8	86	50	77	97	93	93	71	94	83	−23
11	10	91	77	85	93	92	90	84	92	88	− 8
13	13	71	74	64	75	60	90	72	75	74	− 3
Av. 9.6	8	81.8	67.6	70.9	80.8	81.2	76.4	73.7	79.4	76.4	−5.7
% N	....	100	90	90	100	100	78	90	100	100	100

TABLE 21

Percentiles of Measurements—35 Normal—School Girls

AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.	PHYS. AV.	PS. PH. AV.	TOTAL AV.	PHYS. EXCESS
15	29	29	19	9	7	51	25	22	24	3
	89	79	80	70	91	28	82	63	73	19
	29	41	80	85	96	73	50	85	68	−35
	89	92	69	50	57	71	84	59	72	25
	79	70	79	70	98	100	76	89	83	−13
16	39	50	30	60	40	10	40	37	39	3
	8	9	9	0	−3	−1	9	−1	4	10
	35	29	20	60	60	66	28	62	45	−34
	29	18	76	90	97	97	41	95	68	−54
	16	9	60	71	81	11	28	54	41	−26
17	30	48	92	98	91	98	57	96	77	−39
	10	39	81	21	40	61	43	40	42	3
	38	10	40	7	49	39	29	32	31	− 3
	80	70	95	100	100	89	82	97	90	−15
	29	60	21	99	106	16	37	74	55	−37
18	80	87	96	70	40	81	87	63	75	24
	93	59	49	26	85	75	67	62	65	5
	92	53	47	20	8	9	64	12	38	52
	19	10	40	90	50	36	23	58	41	−35
	10	8	20	80	98	92	13	90	52	−77
19	59	40	91	30	54	82	63	54	59	9
	9	5	69	96	95	13	28	67	48	−39
	9	29	60	19	40	10	33	23	28	10
	8	9	17	30	86	27	11	48	30	−37
	59	40	10	70	77	92	37	80	59	−43
20	29	50	9	20	40	51	30	37	34	− 7
	9	30	10	90	70	36	17	65	41	−48
	9	30	80	8	10	62	40	27	34	13
	10	39	89	90	30	62	47	61	54	−14
	8	59	70	40	30	62	46	44	45	2
21	28	38	91	79	20	14	54	38	46	16
	48	38	50	9	8	77	45	32	39	13
	49	39	41	20	90	88	43	66	55	−23
	98	81	88	70	80	92	89	81	85	8
	11	10	30	89	30	81	13	67	40	−54
Av.....18	39.0	40.2	54.5	55.3	57.5	55.8	44.7	56.6	50.8	−12.0
Per cent N...	29	34	54	60	57	63	34	63	46	71

TABLE 22

Percentiles of Measurements.—35 Normal—School Boys

AGE	STAND. HT.	SIT. HT.	WT.	R. GRIP	L. GRIP	VIT. CAP.	PHYS. AV.	PS. PH. AV.	TOTAL AV.	PHYS. EXCESS
15	91	68	79	72	10	98	79	57	68	22
	89	61	81	98	97	92	77	96	87	− 19
	68	8	41	89	95	73	39	85	62	− 46
	91	82	79	99	90	97	84	96	90	− 12
	18	28	18	50	50	33	21	44	33	− 23
16	30	19	30	60	52	53	27	55	41	− 28
	39	46	49	95	88	37	44	73	59	− 29
	30	19	9	20	70	45	20	45	33	− 25
	19	10	20	92	98	39	17	76	47	− 59
	10	12	11	50	41	11	11	33	22	− 22
17	21	59	19	60	21	29	33	37	35	− 4
	9	19	10	60	49	18	13	43	28	− 30
	28	38	18	48	60	58	28	56	42	− 28
	8	9	19	17	60	9	12	29	21	− 17
	9	9	8	10	21	24	9	18	14	− 9
18	−1	8	9	59	40	44	5	48	27	− 43
	19	11	4	20	9	19	11	16	14	− 5
	31	31	20	89	90	48	27	76	52	− 49
	29	20	9	40	40	31	20	37	29	− 17
	49	21	20	96	85	48	30	77	54	− 47
19	81	83	52	60	39	81	72	60	66	12
	60	72	70	91	101	73	67	88	78	− 21
	19	20	10	31	40	32	17	35	26	− 18
	21	10	39	20	30	41	23	30	27	− 7
	79	78	49	70	89	53	69	71	70	− 2
20	31	39	38	9	70	69	36	49	43	− 13
	19	10	8	10	30	8	12	16	14	− 4
	78	89	50	20	70	90	73	60	67	13
	59	31	51	99	93	69	47	87	67	− 40
	29	39	21	11	40	18	30	23	27	7
21	19	9	−1	9	4	18	9	10	10	− 1
	31	9	11	30	80	79	17	63	40	− 46
	79	76	61	30	101	88	72	73	73	− 1
	31	9	−1	20	9	−2	13	9	11	4
	72	60	18	79	98	89	50	89	70	− 39
Av....18	40	34.6	29.4	51.8	58.9	48.9	34.7	53.2	44.2	−18.5
Per cent N....	31	29	23	54	57	43	26	18	40	95

used. Table 20 presents measurements on 3 girls and 6 boys, unquestionably normal or super-normal children who had been examined at the Vineland Laboratory. Tables 21 and 22 present data from 70 Westchester Normal School students, 35 of each sex, 5 at each age from 15 to 21 years. These measurements are from individual percentile curves constructed under the direction of Dr. H. H. Goddard by a student at the Westchester Normal School. They are based on gymnasium measurements taken without clothing; strength of grip was measured with a Collin dynamometer (oval type), and vital capacity with a large bore wet spirometer. From the Vineland Laboratory files additional data were collected relating to 21 cases of "potential feeble-mindedness," subjects who at the time of examination did not show the three years of mental retardation which is customarily regarded as necessary for a diagnosis of mental defect.[6] These subjects are all included in the major tables and curves, but the data presented here are from first measurements on them instead of last, and are not necessarily the same. First measurements were chosen in order to get data on each individual when retardation was least apparent. These data are shown in Table 19.

From the averages of these tables, 19, 20, 21 and 22, we are able to construct type curves (pp. 66, 73, 74). It is at once clear that the normal curves are significantly different from the general feeble-minded curves and that the potential feeble-minded curve very closely resembles the general feeble-minded curve. We wish particularly to call attention, however, to the accelerated physical development of these potential feeble-minded. We have long since observed that some children at the point of complete mental retardation show physical acceleration, but have vainly attempted to account for this fact. A half-dozen explanations offer themselves, but no one of them is satisfactory or is free from serious objections. Possibly the explanation may lie in physiological precocity, but then this also must

[6] Obviously, an individual can not be three years retarded before a certain age; it requires a certain length of time before a child predestined (by reason of heredity or "accident") to feeble-mindedness, shows the full degree of defect. Most cases of feeble-mindedness arrive at their final mental level after a process of gradual retardation, although there is evidence showing that some cases develop quite differently. The exact nature of this retardation is a most important question already under investigation, as is also the means of diagnosing such cases before mental arrest is complete. (Cf. E. A. Doll, *Preliminary Note on the Diagnosis of Potential Feeble-Mindedness*, Training School Bulletin, Vol. XIII, No. 3, May, 1916.) As McCready points out (Medical Record, Aug. 23, 1913), it is most important to diagnose these types early in their history and, if possible, before the complete feeble-mindedness is manifest. The data in Table 19 are exceedingly important as aids to this diagnosis.

Type--Feeble-Minded, Imbecile

ANTHROPOMETRIC MEASUREMENTS

Name Ben —, C — Born 12/2/00

Date 2/13/14 Time 8.15 Mental Age 5.2

Examiner C — Observers —

Standing height 1618 R. Grip 19.5 — 70 — 70

Sitting height 732 L. Grip 20.0 — 66 — 18

Weight 32.6 Vit. Cap. 820 — 10 — 30 — 27 — 5 — 27 — 7

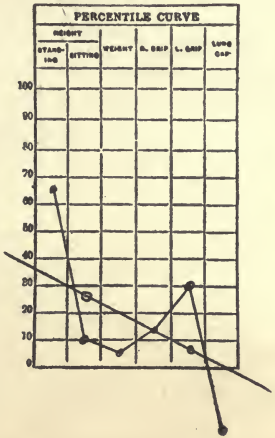
Sex M Slope = 27/7

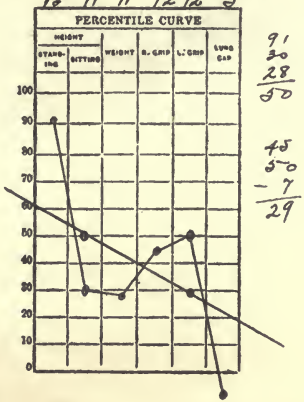
Age 13.8 Av. for age 12 S = 50/29

R = −8.6

13 11 11 12 12 5

PERCENTILE CURVE





91 30 28 50

45 50 − 7 29

Type--- Potential feeble-minded.

ANTHROPOMETRIC MEASUREMENTS

Name Fitz —, Cor — Born 9/27/02

Date 10/20/13 Time 4.00 Mental Age 7.2

Examiner C — Observers —

Standing height 1335 R. Grip 11.5 — 70 — 70

Sitting height 730 L. Grip 11.0 — 92 — 25

Weight 299 Vit. Cap. 1120 — 94 — 30 — 90 — 12 — 92 — 22

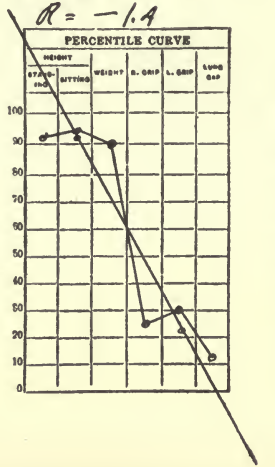
Sex M Slope = 92/22

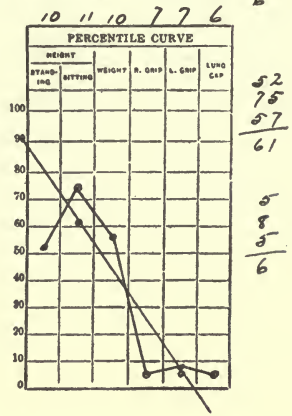
Age 8.6 Av. for age 10 S = 61/6

R = −1.4

10 11 10 7 7 6

PERCENTILE CURVE





52 75 57 61

5 5 5 6

PLATE II. INDIVIDUAL TYPE RECORDS.

INDIVIDUAL TYPE RECORDS

Type---Normal child

ANTHROPOMETRIC MEASUREMENTS

Name J——, E—— Born 5/7/06

Date 5/27/14 Time 4 00 Mental Age 10.6

Examiner E. A. D. Observers ——

Standing height 1305 R. Grip 22.0 — % 86 50 77 71

Sitting height 675 L. Grip 18.5 — % 97 93 93 94

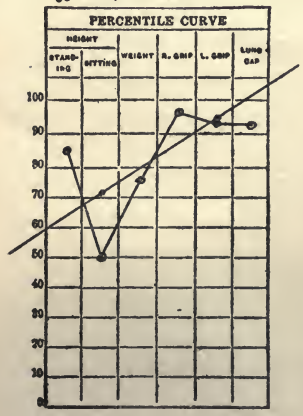
Weight 26.8 Vit. Cap. 1790

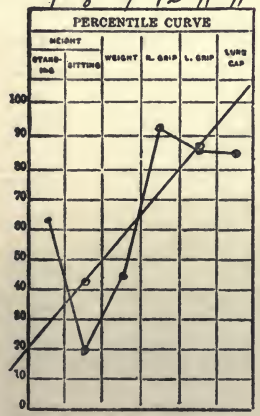
Sex M Slope = 71/94

Age 8 Av. for age 9 S = 42/88

R = +2.6

9 8 9 12 11 11





% 63 20 44 42 92 87 86 86

Type---Normal-School student

ANTHROPOMETRIC MEASUREMENTS

Name Nestchester, —— Born ——

Date —— Time —— Mental Age ——

Examiner —— Observers ——

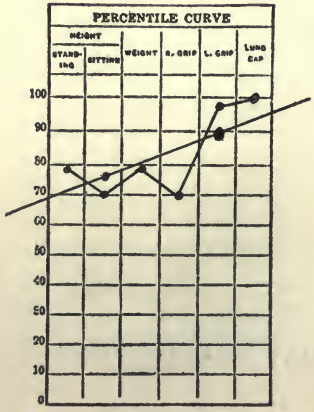
Standing height 1618 R. Grip 30.0 — % 79 70 79 76

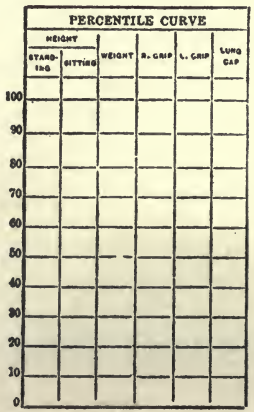
Sitting height 856 L. Grip 44.0 — % 70 98 100 89

Weight 53.6 Vit. Cap. 3400

Sex F Slope = 76/89

Age 15 Av. for age ——





be explained. At present the very important point to be emphasized is that individual cases of ultimate feeble-mindedness do show the typical feeble-minded characteristics in their anthropometric curves, with sometimes the addition of physical precocity, and fail to show the typical characteristics of normal curves.

Tables 18–22 and the type curves are important not only in showing typical characteristics of normal and feeble-minded measurements and curves, but also in verifying the underlying theory of the entire argument and the reliability of the method.

Limitations

Such an investigation as this necessarily has its limitations. It may be well to specify such of these as appear to affect the value of the study and the validity of the conclusions.

1. *Subjects.* The subjects of the research are few in number. They represent all grades and clinical types of feeble-mindedness except those having significant physical defects. The analysis of the data by conditions of mental age and sex gives but a small group of cases for each condition studied. The control groups are limited in number.

2. *Method.* The measurements though reliable are incidental, selected from a file of routine research material. While this may relieve them of any possible suspicion of bias of examination or selection of subjects, it makes them open to variations due to examiners, time of day, season, incentive, and the like. To admit the possibility of such variation does not at all admit any really serious lack of homogeneity of experimental data; these variations of experimentation are all exceedingly limited in their effect upon the original data, aud the diagnostic values are sufficiently marked to offset them.

More serious as a matter of method is the absence of second and third sets of measurements to permit of calculating the reliability coefficient. Such repeated measurements were indeed available on many of the cases but not in sufficient numbers to warrant the enormous amount of additional statistical study that would be entailed in their consideration. From a survey of this material and from our own experience we feel safe in maintaining that the reliability coefficient, if obtainable, would be sufficiently high to support the conclusions already presented.

Conditions of race, nationality, heredity, environment, personal history, and clinical types of feeble-mindedness have not been statistically considered. Here also data were available, but not in sufficient quantity or reliability to warrant statistical treatment. Nevertheless, the importance

of such conditions is fully admitted. Again we feel safe in assuming that the conclusions embodied in previous studies with respect to these influences apply to the feeble-minded as well as to normals. In particular we have not been able to consider the effect of relative physiological development. So far as chronological age covers this point, its effect is apparent, but we are by no means certain that the same relation of physiological to chronological age which has been found with normals holds good for the feeble-minded. That relative physiological development is a most important consideration there can be no question, although we are not at all agreed to assign to it such grave importance as does Crampton in maintaining that "statistics for groups of individuals respecting weight, height, strength, mental or physical endurance, medical or social conditions, that are not referred to physiological age are inconsequential and misleading." In this connection it may be stated that most of the cases coming under our observation and of those included in this study which are exceptions to the general conclusions here set forth are at the preadolescent ages 9–12. Whether these were cases of unusually early physiological maturation we have not been able to determine.

3. *Comparison tables.* This study is also open to the limitations of the Smedley tables which have been used for comparison. These tables may themselves be open to the errors of too few cases, of varying examiners, of selection of cases, et altera, not forgetting the limitations of the percentile method of presenting results. But during the seven years that these tables have been used at the Vineland Laboratory they have proved eminently satisfactory for the purpose outlined in this study. If they err it is in favor of the argument rather than against it. The tables are constructed from measurements of unselected school children, but also include some feeble-minded. Since all studies show that these measurements materially depend upon mental ability, these norms are too low rather than too high. With the backward and feeble-minded children eliminated it is quite possible that the normal average would be at the 60-percentile or higher, instead of at the 50. Our experience with normal subjects tends strongly to confirm such a suspicion. (See section RELIABILITY.)

There is undoubtedly some error in deriving the percentiles which fall outside the Smedley tables, those below 0 and those above 100. This has been unavoidable, and the method used appears to be as little open to criticism as any.

4. *Normal average.* We have assumed throughout that the normal average lies at the 50-percentile for all measurements, basing the assumption upon the type of distribution presented by the tables. For the individual measurements this is probably fair, although, to be sure, it may not at all

hold for the physical, psycho-physical, and total averages, nor yet for the physical excess. The warrant for assuming that it does, lies in the theoretical distribution of individual measurements. We are satisfied that the assumption is reasonably correct, but to just what age it holds for the excess cannot be determined. The normal variability also should be determined. Suffice it that several years of examining strongly verifies the validity of these assumptions. Until a similar investigation has been made with normal children we must rest on these assumptions which seem theoretically justified.

5. *Comparison percentiles.* The percentiles were originally adopted in order to permit of comparison with each other and with mental ages unaffected by age and sex. It was expected that these percentiles could then be pooled for any purpose. That the percentiles did not entirely eliminate chronological age and sex has been demonstrated, but from the demonstration several important conclusions have been developed. The objection may be made that the original measurements should have been used in the correlations and then corrected for irrelevancies of age and sex. This, however, would have destroyed the diagnostic value of the material, which lies in the inter-relations of the comparative percentiles and in the physical excess. Such a study, moreover, would have been valuable in itself alone. Furthermore, a test-case in computing correlations from individual absolute measurements and correcting for irrelevancies, gave coefficients closely similar to those derived from the percentiles. The enormous amount of additional statistical computation involved was prohibitive considering the slight return. Such computations can be made, however, by such as desire; the original data are presented in full.[7]

[7] The results of this test-case (from the data for girls) are summed up in the following table:

TERMS	RAW COEFFICIENT	CORRECTION	CORRECTED COEFFICIENT
mm. Stan. Ht. — Ment. age.....	.46	Corrected for chron. age	.31
% " " — " "	.30	" " " "	.39
kg. Weight—Ment. age.....	.42	" " " "	.23
% " — " "	.36	" " " "	.34
mm. Stan. Ht.—kg. Weight.....	.82	" " both ages	.65
% " " —% "	.64	" " " "	.62
mm. Stan. Ht.—Chron. age.....	.65	" " ment. age.....	.57
kg. Weight " "	.69	" " " "	.64

The correlations between percentiles and chronological age are not comparable with those between original measurements and age.

6. The results are not explained nor are definite conclusions drawn, except for diagnostic purposes. To explain the results would necessitate a far more thorough understanding of the physiology and biochemistry of each case than is avilable. This falls outside our field, and if it did not would entail untold research in itself vastly exceeding the present investigation. We are content to present our results as facts, hoping that the setting forth of them may encourage others to delve more deeply than we could possibly go.

Notwithstanding these avowed limitations and fully admitting the possibly limited applicability of the results it is perhaps not too much to hope that the study fully justifies a point of view and has sufficiently proved a theory to warrant its more complete investigation under other and better circumstances.

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Note: This bibliography in no way pretends to cover the whole field of anthropometry and its related subjects. The titles include only those which are referred to in the discussion, and these references bear chiefly on the relation of the measurements to mental capacity. The references, moreover, are by no means complete, but merely representative. Most of these titles have been selected from the annotated bibliography included in Baldwin's study (2) and from the more specific reference citations in Whipple's Manual (26).

APPENDIX

Smedley's Percentile Tables

Percentiles.—Four-year-old Boys. No. of Cases, 58

PER CENT	HEIGHT, STANDING	HEIGHT, SITTING	WEIGHT	GRIP OF R. HAND	GRIP OF L. HAND	VITAL CAPACITY
	mm.	*mm.*	*kg.*	*kg.*	*kg.*	*cc.*
100	1165	624	21.600	11	10.5	1050
90	1096	614	20.375	9	8.5	875
80	1063	610	18.775	8	7.5	800
70	1038	598	17.850	7.25	7	800
60	1029	593	17.275	7	6	750
50	1018	587	17.000	6	6	700
40	1010	583	16.600	5.5	5	700
30	997	578	16.250	5	4.5	650
20	986	568	15.875	4	4	600
10	964	554	14.550	3.5	3	600
0	866	502	12.900	3	2	500

Percentiles.—Five-year-old Boys. No. of Cases, 123

100	1183	697	26.650	16	15.5	1250
90	1124	643	21.550	11	11	1075
80	1112	630	20.100	10	9.5	1000
70	1100	625	19.350	10	9	1000
60	1090	617	18.750	9.25	8.75	950
50	1079	612	18.475	9	8	900
40	1065	606	17.950	8	7.5	900
30	1055	601	17.600	7	7	850
20	1045	595	17.075	6.5	6	800
10	1030	588	16.675	5	4.5	750
0	969	550	13.725	4	3	650

Percentiles.—Six-year-old Boys. No. of Cases, 341

100	1289	707	29.600	16.5	16.5	1600
90	1200	688	23.525	13.5	13	1325
80	1179	657	22.725	12	11.5	1225
70	1159	648	21.950	11.5	11	1200
60	1148	641	21.100	11	10.5	1125
50	1135	635	20.475	10.5	10	1100
40	1123	630	20.050	10	9.5	1075
30	1112	623	19.575	10	9	1000
20	1093	616	19.050	9	8	975
10	1067	603	18.275	8	7	900
0	988	568	15.875	5	4	700

SMEDLEY'S PERCENTILE TABLES—Continued

Percentiles.—Seven-year-old Boys. No. of Cases, 432

PER CENT	HEIGHT, STANDING	HEIGHT, SITTING	WEIGHT	GRIP OF R. HAND	GRIP OF L. HAND	VITAL CAPACITY
	mm.	*mm.*	*kg.*	*kg.*	*kg.*	*cc.*
100	1360	732	32.025	20	20	1750
90	1248	689	25.600	15	14.5	1475
80	1225	679	24.500	14	13	1400
70	1212	670	23.800	13	12.5	1300
60	1200	664	23.000	12.5	12	1300
50	1190	658	22.450	12	11.5	1225
40	1172	652	21.900	11.5	11	1200
30	1163	644	21.200	11	10.5	1150
20	1146	638	20.650	10	10	1100
10	1125	626	19.850	9	9	1000
0	1036	587	17.000	5	5	700

Percentiles.—Eight-year-old Boys. No. of Cases, 428

100	1382	756	62.200	24	22	2100
90	1320	710	28.800	18	17	1700
80	1278	700	27.100	16.5	15.5	1575
70	1262	690	26.025	15	14	1500
60	1245	683	25.300	14.5	13.5	1400
50	1230	676	24.300	13.5	13	1350
40	1216	670	23.900	13	12	1300
30	1201	662	23.175	12	11	1250
20	1185	653	22.350	11	10	1200
10	1161	642	21.450	10	9	1100
0	1097	607	17.900	7	7	800

Percentiles.—Nine-year-old Boys. No. of Cases, 373

100	1478	786	38.600	30	25	2250
90	1369	733	31.575	20	19	1850
80	1336	722	30.000	18	17.5	1700
70	1316	713	29.025	17	16	1625
60	1299	706	28.125	16.5	15	1600
50	1285	697	27.200	16	15	1500
40	1274	690	26.500	15	14	1450
30	1261	683	25.575	14	13	1400
20	1243	674	24.800	13	12	1300
10	1214	664	23.650	11.5	11	1225
0	1072	585	20.000	8	7	850

SMEDLEY'S PERCENTILE TABLES—Continued

Percentiles.—Ten-year-old Boys. No. of Cases, 399

PER CENT	HEIGHT, STANDING	HEIGHT, SITTING	WEIGHT	GRIP OF R. HAND	GRIP OF L. HAND	VITAL CAPACITY
	mm.	*mm.*	*kg.*	*kg.*	*kg.*	*cc.*
100	1479	780	50.400	32	26.5	2750
90	1415	746	34.500	22	20	2000
80	1380	735	32.525	20	19	1900
70	1362	726	31.400	19	18	1800
60	1345	720	30.200	18	17	1700
50	1332	714	29.450	17	16	1650
40	1318	707	28.525	16.5	15	1600
30	1304	700	27.750	16	14.5	1500
20	1287	693	26.850	14.5	13	1450
10	1259	679	25.375	13	12	1350
0	1166	555	19.500	10	8	900

Percentiles.—Eleven-year-old Boys. No. of Cases, 356

100	1639	819	52.400	31	26.5	3000
90	1452	767	37.865	25	23	2200
80	1425	755	35.650	23	21	2050
70	1403	748	34.300	21	20	1975
60	1389	739	33.285	20	19	1875
50	1378	730	32.162	19	18	1800
40	1357	723	31.200	18	17	1725
30	1342	714	30.075	17	16	1650
20	1324	706	28.855	16	15	1550
10	1291	692	27.675	15	13	1400
0	1131	632	18.850	11	10	1100

Percentiles.—Twelve-year-old Boys. No. of Cases, 373

100	1613	837	64.375	37	32	3150
90	1507	786	42.350	28	26	2400
80	1479	773	40.800	26	24	2225
70	1457	764	37.700	24	22	2100
60	1437	757	36.350	23	21	2025
50	1421	749	35.200	22	20	1950
40	1403	741	33.525	21	19	1875
30	1381	732	33.000	20	18	1800
20	1364	722	31.300	18	17	1700
10	1330	710	29.700	17	15	1600
0	1252	642	25.200	10	9	1150

SMEDLEY'S PERCENTILE TABLES—Continued

Percentiles.—Thirteen-year-old Boys. No. of Cases, 353

PER CENT	HEIGHT, STANDING	HEIGHT, SITTING	WEIGHT	GRIP OF R. HAND	GRIP OF L. HAND	VITAL CAPACITY
	mm.	*mm.*	*kg.*	*kg.*	*kg.*	*cc.*
100	1730	944	72.700	62	50	4200
90	1599	831	48.400	33	31	2750
80	1557	808	44.800	30	28	2500
70	1528	794	42.850	28	26	2350
60	1505	782	40.925	26	24	2300
50	1484	770	38.800	25	23	2200
40	1462	763	37.700	23	21	2100
30	1446	756	36.450	22	20	2000
20	1428	747	35.100	21	19	1900
10	1400	734	33.150	19	17.5	1800
0	1311	696	28.150	13	10	1500

Percentiles.—Fourteen-year-old Boys. No. of Cases, 359

100	1763	950	68.325	56	51	4400
90	1666	868	55.300	40	36	3300
80	1614	845	51.150	35	32	2950
70	1592	826	47.975	32	30	2750
60	1569	813	45.900	30	28	2575
50	1550	802	44.125	28	26	2450
40	1523	790	42.050	26	25	2300
30	1492	778	40.150	24	23	2200
20	1468	765	37.900	22.5	21	2100
10	1435	750	35.200	21	19	1850
0	1305	700	25.900	15	14	1200

Percentiles.—Fifteen-year-old Boys. No. of Cases, 262

100	1846	958	97.925	63	61	4550
90	1715	900	61.673	47	45	3650
80	1682	881	57.150	43	39	3400
70	1652	865	54.425	40	38.5	3200
60	1629	850	52.200	38	35	3000
50	1616	837	50.100	35	32	2800
40	1589	821	48.350	32	30	2700
30	1562	810	46.375	30	28	2500
20	1538	796	43.125	28	26	2350
10	1493	775	39.650	26	23	2150
0	1323	647	30.150	14	15	1400

SMEDLEY'S PERCENTILE TABLES—Continued

Percentiles.—Sixteen-year-old Boys. No. of Cases, 174

PER CENT	HEIGHT, STANDING	HEIGHT, SITTING	WEIGHT	GRIP OF R. HAND	GRIP OF L. HAND	VITAL CAPACITY
	mm.	*mm.*	*kg.*	*kg.*	*kg.*	*cc.*
100	1853	957	105.625	85	79	5100
90	1750	923	66.090	50	48	4200
80	1732	907	61.770	48	45	3800
70	1706	895	58.700	45	42	3600
60	1687	886	57.350	44	40	3500
50	1672	876	55.500	41	38	3300
40	1650	861	53.350	39	36	3150
30	1618	849	50.725	36	34	2950
20	1593	835	48.600	34	31	2800
10	1550	810	45.675	30	26	2400
0	1420	724	34.550	17	16	1800

Percentiles.—Seventeen-year-old Boys. No. of Cases, 106

100	1828	963	81.400	72	67	5000
90	1776	944	70.975	58	51.5	4350
80	1737	925	66.150	53	48	4000
70	1722	916	64.100	51.5	46	3850
60	1711	910	61.350	49	45	3700
50	1684	897	58.975	45.5	43	3575
40	1678	887	57.200	43.5	40	3450
30	1662	876	55.000	41	38	3250
20	1642	866	53.400	39	35	3125
10	1604	838	49.200	35.5	32	2900
0	1376	737	34.225	20	18	1750

Percentiles.—Eighteen-year-old Boys. No. of Cases, 46

100	1839	997	83.800	71	68	5000
90	1814	955	71.360	62	58	4750
80	1784	937	67.340	58	52	4200
70	1764	932	65.600	54	49	4125
60	1748	929	64.875	51.5	48	3975
50	1742	926	63.825	49.5	46.5	3850
40	1720	914	62.360	48	45	3600
30	1695	902	60.100	46	41	3500
20	1677	886	56.440	44	39	3350
10	1659	865	53.800	41	35	3200
0	1610	830	45.575	36	31	2450

SMEDLEY'S PERCENTILE TABLES—Continued

Percentiles.—Boys, Nineteen and Twenty Years. No. of Cases, 44

PER CENT	HEIGHT, STANDING	HEIGHT, SITTING	WEIGHT	GRIP OF R. HAND	GRIP OF L. HAND	VITAL CAPACITY
	mm.	*mm.*	*kg.*	*kg.*	*kg.*	*cc.*
100	1979	1010	98.000	77	62	5625
90	1831	964	74.874	64	60	4850
80	1786	947	70.230	61	53	4460
70	1758	924	68.360	60	52	4100
60	1739	920	66.560	57	50	3940
50	1728	910	63.300	51	48	3825
40	1708	903	59.990	50	46	3660
30	1697	888	57.425	47	42	3500
20	1652	884	54.740	46	40	3280
10	1637	858	53.775	42	38	3100
0	1481	814	47.625	37	32	2150

Percentiles.—Men, Twenty-one Years and Over. No. of Cases, 46

100	1847	961	92.100	69	67	5500
90	1792	940	74.600	61	59	4840
80	1775	936	70.040	60	57	4480
70	1742	924	69.860	56	54	4320
60	1720	910	68.040	54	50	4150
50	1713	902	66.950	52	49	4100
40	1700	898	65.150	51	48	4000
30	1669	892	62.660	50	46	3900
20	1662	888	58.740	49	45	3700
10	1636	878	56.050	46	44	3300
0	1577	841	53.700	37	34	2950

Percentiles.—Four-year-old Girls. No. of Cases, 58

100	1161	650	21.975	9.5	9	875
90	1059	610	19.100	9	8	850
80	1043	600	18.150	7.5	7	825
70	1030	592	16.850	7	6.5	800
60	1020	585	16.575	6.5	6	800
50	1008	577	16.300	6	5.25	800
40	994	574	16.000	5.25	5	700
30	984	571	15.700	5	5	670
20	974	568	15.125	4	4	650
10	955	554	14.600	4	3	635
0	926	543	12.800	2.5	2	600

SMEDLEY'S PERCENTILE TABLES—Continued

Percentiles.—Five-year-old Girls. No. of Cases, 116

PER CENT	HEIGHT, STANDING	HEIGHT, SITTING	WEIGHT	GRIP OF R. HAND	GRIP OF L. HAND	VITAL CAPACITY
	mm.	*mm.*	*kg.*	*kg.*	*kg.*	*cc.*
100	1184	662	23.600	13	11.5	1150
90	1137	631	20.600	10	9.5	975
80	1115	624	19.800	9	8.5	950
70	1091	616	18.975	8.5	8	900
60	1080	610	18.400	8	7	900
50	1067	602	17.850	7.5	7	850
40	1055	597	17.150	7	6.5	800
30	1042	591	16.625	6.5	6	800
20	1022	584	16.000	6	5	775
10	1001	572	15.200	5	4	700
0	937	533	13.300	3	2	600

Percentiles.—Six-year-old Girls. No. of Cases, 338

100	1282	699	29.250	15.5	15	1400
90	1191	664	23.050	12	11	1275
80	1168	654	21.950	11	10	1175
70	1152	644	21.325	10	10	1100
60	1136	635	20.500	10	9	1050
50	1125	629	19.900	9.5	9	1000
40	1114	623	19.450	9	8	950
30	1101	617	18.850	8.5	8	900
20	1088	610	18.225	8	7	850
10	1065	597	17.200	7	6.5	800
0	959	556	13.850	4	4	600

Percentiles.—Seven-year-old Girls. No. of Cases, 423

100	1341	719	31.800	16	16	1650
90	1241	682	25.250	14	13	1300
80	1220	673	23.900	12.5	12	1250
70	1202	665	23.000	12	11	1200
60	1190	659	22.375	11	10.5	1150
50	1180	653	21.675	11	10	1100
40	1170	646	21.025	10	9.5	1050
30	1152	639	20.425	10	9	1000
20	1134	632	19.800	9	8	975
10	1113	620	18.550	8	7.5	900
0	975	585	15.350	5	4	750

SMEDLEY'S PERCENTILE TABLES—Continued

Percentiles.—Eight-year-old Girls. No. of Cases, 401

PER CENT	HEIGHT, STANDING	HEIGHT, SITTING	WEIGHT	GRIP OF R. HAND	GRIP OF L. HAND	VITAL CAPACITY
	mm.	*mm.*	*kg.*	*kg.*	*kg.*	*cc.*
100	1408	757	41.175	20	19	1800
90	1300	704	27.700	15	14	1450
80	1274	693	26.150	14	13	1350
70	1257	685	25.300	13	12	1300
60	1245	678	24.400	12.5	11.5	1250
50	1233	673	23.800	12	11	1200
40	1221	667	23.050	11	10	1150
30	1205	660	22.400	10.5	9.5	1100
20	1188	653	21.550	10	9	1000
10	1165	642	20.700	9	8	950
0	1052	603	17.175	6	5	500

Percentiles.—Nine-year-old Girls. No. of Cases, 334

100	1436	798	41.550	24	22.5	2100
90	1356	729	31.040	17	16	1600
80	1323	715	29.105	15.5	14.5	1500
70	1311	706	28.120	15	14	1450
60	1296	700	27.135	14	13	1400
50	1283	692	26.340	13	12.5	1325
40	1270	686	25.580	13	12	1300
30	1252	680	24.600	12	11	1200
20	1235	670	23.790	11	10	1200
10	1209	659	22.710	10	9	1100
0	1073	613	19.150	7	6	800

Percentiles.—Ten-year-old Girls. No. of Cases, 369

100	1577	806	58.225	32	31	2150
90	1411	750	34.700	19.5	18	1775
80	1382	735	32.150	17	16	1650
70	1359	724	31.200	16	15	1550
60	1342	717	29.750	15.5	14.5	1500
50	1326	710	28.665	15	14	1450
40	1307	703	27.775	14	13	1400
30	1295	695	26.550	13	12	1325
20	1279	690	25.550	12	11	1300
10	1248	673	24.000	11	10	1200
0	1157	630	19.300	8	6	800

SMEDLEY'S PERCENTILE TABLES—Continued

Percentiles.—Eleven-year-old Girls. No. of Cases, 341

PER CENT	HEIGHT, STANDING	HEIGHT, SITTING	WEIGHT	GRIP OF R. HAND	GRIP OF L. HAND	VITAL CAPACITY
	mm.	*mm.*	*kg.*	*kg.*	*kg.*	*cc.*
100	1576	855	55.600	27	25	2400
90	1487	784	38.825	21.5	21	1950
80	1443	763	36.290	20	19.	1800
70	1420	753	34.566	19	18	1700
60	1405	745	32.560	18	17	1650
50	1388	737	31.300	17	15.5	1600
40	1367	730	30.350	16	15	1500
30	1349	718	29.287	15	14	1450
20	1329	709	28.300	14	13	1400
10	1297	695	26.625	12	11	1300
0	1172	646	21.000	8	8	1000

Percentiles.—Twelve-year-old Girls. No. of Cases, 388

100	1654	866	79.000	34.5	33.5	2950
90	1549	814	45.150	25	24	2200
80	1514	800	41.925	23	22	2025
70	1492	787	40.000	21	20	1950
60	1474	777	38.050	20	19	1825
50	1450	765	36.300	19	17.5	1750
40	1431	757	34.750	18	17	1675
30	1413	746	32.775	17	15	1600
20	1388	735	31.200	16	14.5	1500
10	1361	715	29.500	14.75	13	1400
0	1216	662	21.450	10	7	800

Percentiles.—Thirteen-year-old Girls. No. of Cases, 387

100	1718	912	78.000	45	40	3050
90	1602	849	51.500	30	27.5	2400
80	1578	832	47.650	27	25	2250
70	1558	824	45.000	25	24	2125
60	1540	812	42.950	23.5	22	2000
50	1519	798	41.000	22	21	1925
40	1498	788	39.200	21	20	1850
30	1479	777	37.200	20	18	1775
20	1448	764	35.500	18.5	17	1650
10	1413	746	32.800	17	15	1525
0	1300	683	24.400	10	9	1100

SMEDLEY'S PERCENTILE TABLES—Continued

Percentiles.—Fourteen-year-old Girls. No. of Cases, 425

PER CENT	HEIGHT, STANDING	HEIGHT, SITTING	WEIGHT	GRIP OF R. HAND	GRIP OF L. HAND	VITAL CAPACITY
	mm.	*mm.*	*kg.*	*kg.*	*kg.*	*cc.*
100	1714	915	74.125	38	39.5	3200
90	1640	870	55.600	32	30	2600
80	1617	856	52.000	30	27.5	2400
70	1596	845	49.735	28	26	2300
60	1581	837	48.125	27	25	2200
50	1565	832	46.300	25	23	2100
40	1551	823	44.800	24	22	2000
30	1530	814	43.050	22	21	1927
20	1508	800	40.700	21	19	1800
10	1481	779	37.675	19	18	1700
0	1250	681	29.225	14	12	1350

Percentiles.—Fifteen-year-old Girls. No. of Cases, 448

100	1737	919	81.350	47	47	3400
90	1645	876	57.400	33	31	2650
80	1620	865	53.800	31	29.5	2500
70	1605	856	52.075	30	28	2400
60	1590	847	50.150	29	27	2300
50	1574	840	48.700	28	25	2225
40	1561	831	47.300	26.5	24	2150
30	1547	823	45.500	25	22	2050
20	1529	814	43.300	23	21	1950
10	1506	801	41.250	21	20	1800
0	1391	660	30.975	12	10	1450

Percentiles.—Sixteen-year-old Girls. No. of Cases, 427

100	1785	946	91.775	48	47	3500
90	1663	889	60.415	35	33	2725
80	1636	876	56.540	33	31	2600
70	1622	866	54.525	31	29	2500
60	1604	859	52.790	30	28	2400
50	1593	850	51.150	29	27	2300
40	1580	845	49.375	28	26	2200
30	1560	837	47.630	26.75	25	2100
20	1546	827	46.160	25	23	2000
10	1516	813	43.685	23	21.5	1900
0	1365	643	33.900	18	15	1350

SMEDLEY'S PERCENTILE TABLES—Continued

Percentiles.—Seventeen-year-old Girls. No. of Cases, 413

PER CENT	HEIGHT, STANDING	HEIGHT, SITTING	WEIGHT	GRIP OF R. HAND	GRIP OF L. HAND	VITAL CAPACITY
	mm.	*mm.*	*kg.*	*kg.*	*kg.*	*cc.*
100	1790	945	75.600	45	42	3500
90	1668	890	59.735	37	33.25	2825
80	1644	879	56.600	34	31.5	2600
70	1624	871	54.410	32.5	30	2500
60	1610	860	52.390	31	29	2425
50	1598	852	50.960	30	27.5	2350
40	1582	844	49.460	29	26	2250
30	1568	837	48.365	27.5	25	2150
20	1549	830	46.460	25.5	23	2050
10	1523	821	44.100	24	21.5	1900
0	1438	777	34.200	14	12.5	1250

Percentiles.—Eighteen-year-old Girls. No. of Cases, 343

100	1771	937	82.150	48	47	3675
90	1676	892	59.800	38	34	2900
80	1649	876	57.075	35	32	2700
70	1628	869	55.200	34	31	2600
60	1612	864	53.480	32	30	2500
50	1600	856	52.050	31	29	2425
40	1589	849	50.660	30	27.5	2400
30	1572	842	49.400	29	26	2300
20	1554	833	48.100	27	25	2150
10	1527	825	46.100	25	23	2025
0	1385	743	35.075	17	16	1550

Percentiles.—Nineteen-year-old Girls. No. of Cases, 241

100	1731	940	88.650	52	48.5	3700
90	1681	891	61.392	39	36	3000
80	1652	877	57.730	37	34	2800
70	1635	869	55.785	35	32	2700
60	1617	859	54.150	34	31	2600
50	1597	853	52.137	32	30	2500
40	1585	848	50.655	31	28	2400
30	1568	839	49.400	30	27	2300
20	1545	831	47.200	29	26	2200
10	1519	820	45.050	26.5	24	2025
0	1418	758	33.800	20	20	1700

SMEDLEY'S PERCENTILE TABLES—Continued

Percentiles.—Twenty-year-old Girls. No. of Cases, 175

PER CENT	HEIGHT, STANDING	HEIGHT, SITTING	WEIGHT	GRIP OF R. HAND	GRIP OF L. HAND	VITAL CAPACITY
	mm.	*mm.*	*kg.*	*kg.*	*kg.*	*cc.*
100	1778	953	76.850	44	46	3600
90	1674	895	62.025	38	37	2900
80	1650	882	58.000	36	34	2800
70	1628	872	56.000	35	32	2700
60	1621	865	54.500	34	31	2600
50	1609	858	53.000	33	30	2550
40	1597	851	50.900	32	30	2500
30	1585	845	49.300	31	28	2400
20	1562	838	47.600	30	27	2300
10	1540	822	45.812	28	25	2250
0	1328	697	30.000	18	19	1300

Percentiles.—Female Teachers, Twenty-one Years and Over. No. of Cases, 223

100	1787	931	101.100	47	42	3550
90	1677	892	63.000	39	36	3100
80	1655	882	58.720	37	35	2900
70	1635	876	56.855	35	33	2775
60	1625	868	54.775	34	31	2700
50	1607	861	53.688	33	30	2600
40	1592	854	51.860	32	29	2500
30	1576	847	49.980	31	28	2400
20	1560	834	48.380	30	27	2350
10	1530	823	46.400	28	25	2200
0	1474	797	39.000	22	20	1650

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